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WASHINGTON STATE ELEMENTARY SCHOOL DISABILITY PREVENTION PROJECT

Environmental Health Division
Maternal and Child Health Division

Washington State Elementary School Disability Prevention Pilot Project:

Project Report

- **Introduction**
- **Local Health Capacity Building Section**
- **Elementary School Injury Surveillance Section**

November 25, 1998

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PREFACE

The Washington State Elementary School Injury Surveillance Pilot Project Report was prepared by the Washington State Department of Health. Financial assistance was provided under grant U59/CCU006992-3 from the United States Center for Disease Control and Prevention.

The Report was prepared between December 1996 and December 1997. During this period the Department of Health received input from project participants and others who provided guidance and policy support.

The Department of Health encourages all readers to examine the methods, procedures, findings and recommendations contained in the Report, and to evaluate its usefulness as applied to elementary school injury prevention. Readers are encouraged to make comments to the Department of Health, Office of Community Environmental Health Programs (refer to the address and phone number on the title page).

It is important to recognize that the practices specified or recommended in this Report include some that are specified in Consumer Product Safety Guidelines (CPSC), American Society for Testing and Materials (ASTM) standards, and others which may help promote safer elementary schools. Readers of this Report, including school districts, should evaluate the recommendations and adopt or promote those which, in their judgment are relevant and applicable to their circumstances, and which are feasible to implement.

It is hoped that this report will illustrate the need for more complete and uniform method of voluntary school injury reporting on a statewide basis so that injury trends can be identified and prevention strategies may be implemented.

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Section One

Introduction

EXECUTIVE SUMMARY

Approximately 22 million injuries occur among children every year in the United States. Injuries are the leading cause of death and disability in school age children. For children under the age of 17, national survey data shows that schools are the second leading location of injury. A survey by Group Health Cooperative of Puget Sound revealed that injuries occurring at school were more common than injuries occurring at any other location for children between ages ten and nineteen.

According to a review of National Electronic Injury Surveillance Data in 1989 by the Consumer Product Safety Commission, there were over 170,000 playground equipment related injuries requiring emergency room treatment in 1988 alone.

In 1990, Washington State Department of Health published the “School Injury Surveillance Project Report. "This study measured injuries that occur in typical elementary, junior high and high school settings in one county in the state. This report demonstrated an overall school-based injury incidence during the two-year surveillance of 3.36 injuries per 100 student-years. Extrapolating these findings statewide suggested approximately 30,000 injuries requiring treatment away from school were experienced by Washington state school students per year. The greatest proportion of these injuries occurred on the playgrounds. The existence of these injuries occurring in school settings had not been previously reported to local, state and federal public officials.

From 1992 through 1996, a school safety program was developed to address playground injuries and other health and safety issues affecting K-12 students in Washington. Playground inspection programs and a pilot injury surveillance system was developed for use in elementary schools to identify injuries, focusing on, but not limited to, those occurring on playgrounds. The state trained selected local health departments and schools in playground hazard identification, injury surveillance and program plan review. With the expertise obtained through this project, the State Department of Health assisted in the development of Consumer Product Safety Commission and American Society of Testing Materials playground safety standards.

During the years following the development of the surveillance and training programs, the State Department of Health conducted injury research in selected elementary schools throughout the state. The research focused on the settings, mechanisms and causal factors

relating to elementary school injuries, and was more detailed than previous research in terms of the types of playground equipment involved. A number of previously undocumented injury associations were identified, particularly with regard to types of equipment.

Results of this project have been to bring schools and local health staff together, train local health staff on hazard identification, risk communication and public health issues in the school environment, and promote school inspections and injury surveillance in the state's schools. The project also gave schools and local health agencies a base from which to develop their own surveillance systems and assessment tools. Upon completion, the Department of Health will work with schools and the state Superintendent of Public Instruction to develop an appropriate monitoring mechanism to systematically assess the magnitude of the problem and help in developing strategies for injury prevention in the elementary school setting.

Injury rates from the project revealed that schools had a 17.7% overall rate per 100 student-years, with a wide variance in individual schools' injury reporting rates.

At all grade levels boys were injured at a higher rate than girls (19.7 for boys versus 15.2 for girls per 100 student years). Nearly 70% of all injuries were reported to have happened on the playground, and 40% of these involved playground equipment. Nearly half the playground injuries occurred during lunch and lunch recess.

Despite limitations including generalizability, underreporting and the use of inconsistent case definitions, the school injury prevention project has demonstrated that local health departments are willing and able to learn injury prevention techniques and apply them. It has also demonstrated that elementary schools will voluntarily keep track of their student injuries in order to better understand and prevent them.

Recommendations

Public health officials would work with playground equipment manufacturers to develop age-appropriate, safer equipment.

Recommendations for the future include providing adequate state funding to local health agencies, the Department of Health and the Office of the Superintendent of Public Instruction to further explore the effectiveness of and the need for school-based injury surveillance, incorporating modifications and recommendations from this project and a more systematic sampling procedure. This may lead to a more complete understanding of the epidemiology of elementary school injuries and better ways of developing and implementing injury prevention strategies through cooperative efforts.

It is recommended that there be improvement in the inspections of schools, and education of inspectors, parents, teachers and administrators about potential hazards and injury prevention strategies.

Physical site and supervision effects on injury rates from school playgrounds needs further study on a larger scale, using schools that wish to participate voluntarily.

There is a need to provide feedback on the findings from this study to all stakeholders at the state and local level. Through these discussions the Department of Health can continue to develop a more complete picture of the need for injury and safety hazard assessments from all perspectives.

There is also a need to provide injury prevention training to students and staff at schools and day care facilities, including training in hazard identification and risk communication to children.

For further information, please contact Mr. Richard Ellis, School Program Manager, Washington State Department of Health at (360) 236-3072.

THE REPORT'S PURPOSE

This Disabilities Prevention Project Final Report has been written to provide a final record of the capacity building, injury surveillance and injury intervention activities of the Washington State Department of Health Offices of Community Environmental Health and Maternal and Child Health.

The Report focuses on the major activities funded by the United States Department of Health Center for Disease Control. It targets injuries to elementary school children. These hazards affect children during their formative years and in most cases can be reduced or eliminated by proper construction, maintenance and supervision.

The Report also suggests protocols, provides checklists and gives references for further investigation of school injuries and hazards. The broad scope of the report will allow it to be useful in developing school inspection programs, targeted inspections and inventories of playgrounds, training for local health and other professionals, and implementing injury surveillance on a voluntary basis in schools.

Public Health Significance

According to the National Safety Council "Accident Facts", 1992, there were 210,236 hospital emergency room visits during 1989 which were caused by playground equipment injuries, including school playground injuries. Playgrounds account for nearly 200,000 injuries treated in emergency rooms each year, according to a 1988 CDC report, and the CPSC ranked playgrounds as the fifth most hazardous consumer product. We do not know exactly how or how many children are hurt on school playgrounds, but we do know that the amount of litigation and the associated costs are too high.

In Washington and nearly all other states, the causes of school injuries are not well-documented for purposes of epidemiological analysis. In fact, most injuries are not investigated and documented unless there is a perception by the school that the injury is serious enough to produce an insurance claim or litigation. Given current administrative priorities and perceptions, it is commonly heard that there are simply too many "minor" injuries happening at schools to keep track of them. The fact that children get hurt at school is largely accepted as unfortunate but inevitable in many, if not most school systems. Schools are the number one location of injuries to children both nationally and in Washington state. Unfortunately, there are very few groups looking at who is getting hurt at school and exactly where, when and under what circumstances these injuries are occurring.

Injuries and subsequent disabilities happen in many places: vocational shops, parking lots, hallways, gymnasiums, cafeterias, laboratories and

playgrounds, to name a few. When problem areas are discovered there must be good communication among nurses, custodians, facilities and risk managers, teachers, principals, students, parents, agencies and others who may become involved in solving the problem.

The purpose of this Disabilities Prevention Project Final Report is to provide information which will be useful in designing strategies which may prevent primary and secondary disabilities to children in elementary schools, thereby contributing to a safer, healthier and thus more productive school environment.

Who Will Receive The Report?

Primary Distribution

The Disabilities Prevention Project Final Report is primarily intended for:

- the United States Department of Health and Human Services Public Health Service Centers For Disease Control
- state and local health and education officials, and
- school administrators, nurses and risk managers

Others

Other groups that have a significant interest in safety and health issues in schools and may be interested in the results of the activities and research that has been done in Washington State include:

- school facilities and maintenance personnel
- school site councils
- local school boards
- architects
- teachers
- playground equipment designers
- playground equipment manufacturers
- ASTM Playground Committee
- Consumer Product Safety Commission
- other state agencies and organizations including the Office of the Superintendent of Public Instruction, the School Facilities Cost Advisory Board, Washington State Parent Teacher Association, and the Washington State Disabilities Prevention Advisory Council

Organization and Content of the Report

The following components of this report are organized into 2 distinct sections.

- Local Health Capacity Building
- Elementary School Injury Surveillance

A separate report evaluating the surveillance system was prepared and is available upon request from the Department of Health, Division of Community and Family Health.

Section Two

Capacity Building For Local Health Officials

STATE BACKGROUND

In Washington State there are 39 counties where a large number of health statutes and regulations are supposed to be enforced by 33 local health agencies, as required by the state legislature. The K-12 school sanitation regulation is one of the regulations whose provisions are delegated to local health agencies, not the State Department of Health. This is why developing local health capacity, primarily through training provided by the State Department of Health, is so important. Without specific technical knowledge on a wide variety of subjects from basic sanitation to injury prevention, the local agencies' staff are at a disadvantage in performing their assigned tasks.

Washington has approximately 5.7 million residents, the vast majority of whom live in the corridor running from Bellingham on the north, through Seattle and Tacoma, to Vancouver on the south. The Cascade mountains run north and south through the state and split it into two major climatic zones geographically. The west side is relatively wet, with approximately 40 inches of rain annually, while the east side receives about 15 inches, several inches of which falls in the form of snow. The West side is mostly urban and suburban while the East side is mostly suburban or rural. These differences may help partially explain the differences in local health departments' differing abilities and desire to administer the rules and regulations of the State Board of Health and the State Department of Health.

WHY BUILD CAPACITY IN LOCAL HEALTH DEPARTMENTS?

Authority

Since 1911, when the Yakima Health Department was created, Washington has had a strong tradition of delivering health services at the local level. That tradition has been maintained since that time, and when the state legislature later considered who should be responsible for overseeing the health and safety of children in the mandatory public school system created under the Washington State Constitution, it delegated that power and authority to the State Board of Health (SBOH).

The legislature directed the SBOH to create regulations which would specifically govern K-12 schools. This was done after World War Two, and periodic revisions have been done beginning in 1955 and most recently in 1989.

The need to develop local capacity fits in with the legislative and SBOH intent to have local units of government perform routine health and safety oversight over local K-12 schools.

The SBOH delegated to the local health departments the responsibility of pre-construction site and plan review, routine inspections and reporting of rule violations, findings and recommendation to the local school boards and school administrators.

The legislature did not allow for total delegation of power to the Board or the local health departments, however. Recognizing that there were different local capacities at the local level, the legislators retained in the State Department of Health the power to intercede when a local health jurisdiction could or would not perform the required public health functions and could or would not enter into an arrangement with the state to improve performance. It also retained the power in the State Department of Health (DOH) to charge back to local units of government its costs of carrying out required, necessary core public health functions within local jurisdictions (RCW 43.70.130 and 70.05.130).

SISP Report

1990 DOH School Injury Surveillance Project (SISP) Report

During the 1986-87 and 1987-88 school years, the Tacoma Pierce County Health District conducted injury surveillance in the Clover Park school district. This was the first epidemiologically-based school injury surveillance project published in Washington. It is noteworthy that it was performed mainly at the County, not the state level, primarily by involvement between a local environmental health specialist and a willing local school district that volunteered to pilot the concept. In 1990 a final report was issued by the State Department of Health, based on the work of the primary researcher, Dr. Mark Veazie. His recommendations are summarized below.

1. Target injury prevention resources to the leading injury-producing environments such as the playground, physical education, and sports environments. (Example: Revise the health department plan review and inspection procedures.)
2. Playground**:** Focus on preventing falls from equipment.
3. Investigate the causes of injury off equipment, the other equipment category which appears to cause more severe injury, and the high proportion of fractures among injuries occurring on old climbers (i.e. other than Big Toy).

4. Physical Education**:** Focus on volleyball, basketball, and swimming in secondary grades. Investigate the risk factors associated with unspecified PE activities at all grade levels.
5. Competitive Sports: Focus on preventing injury in interscholastic games. Consider the known injury prevention strategies for football, the leading injury generator.
6. Junior High: Investigate the contributing factors and potential prevention measures for the observed high fracture and joint injury rates in junior high and the higher rate of injuries associated with aggressive behavior.
7. Future Investigation**:** Future surveillance activities should: determine activity and school specific rates; produce results in a timely manner; represent the entire county or state; better measure injury severity; include a validity study; evaluate control measures.

Evaluation of SISP

The Tacoma - Clover Park project did fulfill the objectives of providing an epidemiological description of injuries in one school district and pilot tested the concept of school injury surveillance. SISP showed that school-based injury surveillance is plausible. Even with minimal resources, SISP provided some valuable information. The possibilities unveiled and the lessons learned from SISP provided the basis for considering a statewide school injury surveillance system.

According to an evaluation by the Harborview Injury Prevention Center, the SISP rated medium to high on stimulating future investigations, identifying risk factors, and estimating the magnitude of morbidity. A lack of funding resulted in poor performance on flexibility, timeliness, and benefit relative to cost. With adequate funding, the system would have performed well on these criteria. The system rated poorly on improving clinical treatment of injuries because this was not an identified information need. The system also scored poorly on representativeness because it only represents one district. Because the system was not ongoing, it was not possible to evaluate its ability to detect trends and clusters or assess control measures.

The primary constraints to better performance of the study were: a lack of funding, no school specific data, no activity-specific denominator data. It is important to note that good performance on all of the CDC criteria is not expected of any one surveillance system, including the one described in this report.

State Board of Health Reports Address Capacity

The 1992 State Health Plan, published by the State Board of Health, specified two Action Strategies for the school environment: First,

"Provide adequate state funding to local health agencies and the Department of Health to improve and expand inspection of athletic facilities, classrooms, playgrounds, and other facilities, and to educate teachers and administrators about potential hazards found in wood, metalworking, and auto mechanic shop classrooms and areas which go largely uninspected. While guidelines exist relating to hazardous processes, materials, and safety procedures to be followed in classrooms, laboratories and vocational technical programs, the regulations do not include enforcement provisions..."

Second,

"Provide adequate funding to the Office of the Superintendent of Public Instruction to monitor occurrences of health hazards and injuries to students and staff, and to implement prevention programs."

These Action Strategies were repeated, verbatim on page 86 of the report as Service Strategies.

Regulatory strategies were also listed on page 86: " Require safety inspections of school buildings, classrooms, playgrounds and facilities. Strengthen regulations related to air quality in school buildings. Enforce inspection of storage and proper disposal of chemicals and other hazardous materials in school buildings. Adopt as regulations the safety recommendations found in the Office of the Superintendent of Public Instruction's School Science Laboratories: A Guide to Some Hazardous Substances to protect students and teachers from hazardous conditions. Require all schools be tested for radon levels, beginning with those in known high impact areas."

The new Washington State Health Report for 1994 contains essentially all of the above strategies. While some progress has been made, much remains to be done.

Board of Health Resolutions Address Capacity

On June 8, 1994, the Washington State Board of Health made six requests of the state department of health. These requests were made after a presentation by department staff, and are set forth below:

A. Request the Department of Health (DOH), the Office of the Superintendent of Public Instruction (OSPI), local health departments/districts, and the University of Washington School of Public Health and Community Medicine jointly undertake a survey of implementation of Board rules related to public and private schools and school environments, and report to the Board no later than May 1996.

B. Request DOH convene a workgroup of all interested parties to review and recommend revisions to WAC 246-366 - Primary and Secondary Schools, with an interim report to the Board no later than December

1995, and a report to the Board on recommended revisions no later than December 1996.

C. Request DOH convene a workgroup of all interested parties to review school indoor air quality standards and their relation to Board of Health requirements found in WAC 246-366-080 - Ventilation, with a report on best management practices related to school indoor air quality and whether WAC 246-366 needs revision, no later than May 1995

D. Request DOH and OSPI review the potential benefits and costs of having the Board adopt as regulations the safety guidelines found in OSPI's School Science Laboratories: A Guide to Some Hazardous Substances, and in the U.S. Consumer Product Safety Commission's Handbook for Public Playground Safety, and report to the Board by December 1995

E. Request DOH and OSPI "jointly prepare a guide for use by the department (DOH) personnel during routine school inspections in identifying violations of good safety practices." (WAC 246-366-140) Request DOH and OSPI report to the Board on the draft of the guide no later than March 1996

F. Request DOH report to the Board during 1995 with a progress report on its assessment of the pilot school playground injury reporting system, to determine whether the Board should recommend setting up and funding such a system statewide.

To date, resolutions A, C, and F have been completed, and a further report will be made to the board regarding the playground injury reporting system in the summer or fall of 1998. Resolutions B, D, and E are in the process of completion. Finalization of the remaining items is currently planned for 1999.

Relationships with Superintendent of Public Instruction (OSPI)

The role of OSPI in funding school construction is defined by the Board of Education. The school facilities construction manual requires school sites to be approved by the local health officer.

Similarly, the OSPI regulations require that the local health officer give written approval that the construction plans meet health standards prior to funds being released for construction. Again, problems can and do arise.

In one scenario, which occurs fairly frequently, the architect shows up at the Health Department's door a few days or minutes before the bids are about to open and demands a signature on a multi-million dollar project. Sometimes health officers sign, sometimes they don’t. In either case, the essential purpose of an effective health plan review is lost. In one case the school loses their money outright, which is disastrous for the community, and in the other case, the school gets no health input or

assurance that the health codes were effectively addressed. Some county agencies are signing off plans virtually sight-unseen, while others are doing a cursory check of the kitchen and plumbing items.

Only a few counties statewide are performing quality plan reviews, including meetings with the architect and others involved in creating the educational specifications and completing the commissioning of building mechanical systems. Local health departments need training in this area, and OSPI, DOH, and local health agencies are now beginning to establish a closer working relationship, though much remains to be done.

Regional Plan Review

One idea that the Board might consider would be if the rules were changed slightly so that the DOH, in conjunction with OSPI and educational service districts, could develop a regional plan review and site approval service done by state or local health but along the model of the ESD's. The volume of plan reviews at regional centers would mean fewer people would need to be trained by DOH and that those who were trained were using their skills often enough to remain proficient.

Approved Materials List Needed

Another useful change would be to jointly develop an approved materials list for school contractors, especially as related to indoor air and playground safety issues. This would take some time and effort by the agencies involved, but it would bring some needed assurances and certainty into the building contractors and architects arena as well as provide a level of protection to children and other building occupants that is currently not there.

State Public Health Improvement Plan Addresses Capacity

In 1994 the Washington State Department of Health targeted certain populations for investment in health partnerships and promotional activities designed to improve the health of the citizens of the state of Washington. One of the areas they addressed was school playground injuries and school injuries in general.

The Public Health Improvement Plan (PHIP) identified a number of specific tasks that needed to be performed and provided money to local health departments. Among the intervention strategies identified for school playgrounds were:

- Annual inspection of school playgrounds under Board of Health Rules and CPSC guidelines.
- Placement of resilient surfacing underneath all play equipment, depending on its height.

- Plan reviews of playgrounds need to be done before construction, and some existing playgrounds will need to have existing play events moved.
- Supervision of playgrounds must be effective.
- Teachers and children must be trained on the proper use of equipment.
- Promote regular inspection of playgrounds by schools and parent groups.
- Instill principles of fair play and playground rules in children.
- Maintain playground equipment and aerate loose fill materials.

The PHIP established standards for playground injuries at 30.8 hospitalizations per 100,000 citizens in the state for the year 2000 against a 1994 baseline of 36.2 per 100,000.

The Beginning of Capacity Building

In order to implement the recommendations contained in the SISP report on a statewide basis, it was clear that more than one person was needed to lead the way. Unfortunately, as Dr. Veazie observed, resources were and continued to be a limitation at the state level. Therefore, given this problem, it was obvious that the answer was to secure local health department participation. However, the extent of local participation in the school program and their interest and expertise in injury prevention was highly variable.

Dr. Veazie therefore gave several seminars around the state featuring experts in industrial hygiene, lab safety, playground safety and legal authority in an attempt to instruct and encourage local departments to follow the State Board of Health's Rules. The current school program coordinator at the department of health attended one of those seminars and decided to continue Dr. Veazie's work, both on capacity building and on injury surveillance in schools. This collaboration between state and county officials was the basis for the current two-pronged approach to development of the school program in Washington State.

In April of 1992 an informal survey of local health department activities in the school program was conducted by the school program coordinator. The results of that survey are shown in Table 2.1.

REASONS FOR NOT DOING THE SCHOOL PROGRAM

During the course of the survey, many comments and suggestions were made. Perhaps the most frequently heard comment was that local health departments were strapped for funds and the school program was not seen as a fund generator. The second comment that was heard almost unanimously was that there was no systematic ongoing training for the local health inspectors so that they would be competent to perform

safety inspections. A third comment was that there was no public demand for the program. And finally, many suggested that the regulations and guidelines were old and needed to be re-written.

- Based on these comments, a course of action was laid out. First, there needed to be seminars to bring school and health professionals together.
- Next there needed to be one-on-one or small group field training in counties that were seeking to expand into the school program.
- There also needed to be new guidelines and possibly new regulations.
- Finally, there needed to be a clarification of the roles that various agencies play in the school arena.

CAPACITY BUILDING CHRONOLOGY

Obtaining the CDC DPP Grant

In April of 1992, the state injury prevention coordinator informed the school program coordinator of potential grant funding through the CDC Disabilities Prevention Program (DPP) capacity building grant. CDC approved the use of disability prevention funds to support a school playground injury prevention project that started officially on July 1, 1992. This grew into a 5-year effort to prevent playground injuries, pilot injury surveillance in elementary schools and attempt two specific interventions to prevent playground injuries.

The original 3-month proposal was the beginning of a more comprehensive program development effort, including statewide training of staff, speaking engagements, meetings with schools, development of new school safety and inspection guidelines and protocols, indoor air quality best management practices, legislation, and incorporation of playground injury prevention into the state's public health improvement plan and Board of Health reports. It was also the beginning of a multi-district pilot elementary school injury surveillance system designed to be used by elementary schools who wish to track their injuries.

The following yearly account sets forth a chronology of this project's capacity building activities.

1992 (April - September)

In April, 1992, the Washington State Department of Health hired a public health advisor whose duties included managing the environmental health school program. These duties, which were about half-time, included assessing how well local health departments (LHD'S) were complying with the Washington State Board of Health (SBOH) Regulations for

Health and Sanitation in Washington's kindergarten through twelfth grade schools. A telephone survey questionnaire was developed and administered to all of the health jurisdictions in the state for the purpose of establishing a baseline from which to measure future progress. A second, more formal survey was conducted in 1996 (Table 2.1). There were five questions asked of each LHD in 1992:

1. How many K-12 schools are in your jurisdiction?
2. Do you respond to complaints about schools ?
3. Do you conduct plan reviews of new construction and remodeling in schools?
4. Do you perform routine inspections of kitchens in schools?
5. Do you perform safety and overall facilities inspections in schools?

Table 2.1 shows the responses of the LHD's in 1992 to the questions above as well as the 1996 responses related to the safety and facility inspection activities. A comparison of the prevalence of safety and facility inspection activities by LHD's in 1992 and 1996 shows that in 1992 there were only 5 LHD's doing safety inspections in schools in Washington State even though this activity was required by the State Board of Health regulations. By 1996 there were 12. This increase was largely due to the playground safety and other training provided by DOH as part of the capacity building activities of the disabilities prevention grant. Other findings from the 1992 survey suggest that in other areas besides safety and facilities inspections (i.e. responding to complaints about schools, inspecting kitchens and performing plan reviews) the LHD's were generally carrying out their required activities.

Table 2-1

Calendar Years 1992 and 1996 Survey of LHD School Activities

Agency Code #	Complaints	**Plan Review**	**Kitchens**	**Safety & Facility - 92**	**Safety & Facility - 96**
1	YES	**NO**	**NO**	**NO**	**NO**
2	YES	YES-food	YES	**NO**	**NO**
3	YES	YES-food	YES	**NO**	YES
4	YES	YES-food	YES	**NO**	YES
5	YES	YES	YES	**NO**	YES
6	YES	**NO**	**NO**	**NO**	**NO**
7	YES	YES-food	**NO**	**NO**	**NO**
8	YES	YES	**NO**	**NO**	YES

Agency Code #	Complaints	**Plan Review**	**Kitchens**	**Safety & Facility - 92**	**Safety & Facility - 96**
9	YES	YES-food	YES	**NO**	**NO**
10	YES	YES	YES	**NO**	**NO**
11	YES	YES-food	YES	**NO**	**NO**
12	YES	YES	YES	YES	YES
13	YES	YES-food	YES	**NO**	**NO**
14	YES	YES-food	YES	**NO**	**NO**
15	YES	**NO**	YES	**NO**	**NO**
16	YES	YES-food	YES	YES	**NO**
17	YES	**NO**	**NO**	**NO**	YES
18	YES	YES	YES	YES	**NO**
19	YES	YES-food	YES	**NO**	YES
20	YES	YES-food	**NO**	**NO**	**NO**
21	YES	YES-food	**NO**	**NO**	**NO**
22	YES	YES	YES	**NO**	**NO**
23	YES	YES-food	YES	**NO**	YES
24	YES	YES	YES	**NO**	YES
25	YES	YES	YES	**NO**	YES
26	YES	YES	YES	YES	YES
27	YES	YES	YES	**NO**	**NO**
28	YES	YES	YES	YES	YES
29	YES	YES-food	YES	**NO**	**NO**
30	YES	YES	**NO**	**NO**	YES
31	YES	YES-food	YES	**NO**	**NO**
32	YES	**NO**	**NO**	**NO**	**NO**

THE PLAYGROUND INJURY PREVENTION PROJECT

On July 31, 1992, the Department of Health (DOH) received a copy of a FAX transmission signed by Henry S. Cassell, III indicating that the Office of Community Environmental Health Programs was authorized to hire a School Safety Specialist as part of the rebudget request of grant #U59/CCUOO6992-01 (State-based Disabilities Prevention Program).

Pursuant to that approval, the Department of Health (DOH) hired Thom Thompson, a recognized expert in the field of school playground injury prevention. Mr. Thompson had already been working on an ad-hoc basis with the department in anticipation of formal grant approval. It was in large part due to this early start that DOH was able to accomplish all of the expected deliverables in the remaining three months of the first grant year.

The capacity building activities conducted by the department of health since 1992 are described below. The activities related to school injury surveillance, while briefly touched on here, are discussed more fully in Section 3, Elementary School Injury Surveillance.

Assessments of existing physical site hazards were performed on five playgrounds in the East Valley School District in Spokane, Washington. Three sites were assessed in the Tumwater School District in Olympia, WA, and three sites were assessed in the Evergreen School District in Vancouver, Washington. Additional assessments were done in Spokane School District # 81. The U.S. Consumer Product Safety Commission (CPSC) Handbook for Public Playground Safety was used as the basis for the hazard assessments. The grant called for assessments to be done in three health jurisdictions, and this is what was accomplished, although more sites were assessed than originally anticipated due to the high level of interest in Spokane.

Technical training on playground hazards and children's play patterns was provided by Thom Thompson to Richard Ellis (School Safety Project Council) on all sites mentioned above. Mr. Thompson and Mr. Ellis also provided training to 4 local sanitarians and 3 school officials in Vancouver. Technical training and assistance was provided to 2 local sanitarians and 5 local school officials in Spokane. In Olympia there were 5 local sanitarians and 1 school official involved in receiving technical training. The training involved three days of field training on playground hazard assessment at playgrounds in the respective school districts. The training was successful in raising the skill levels of both the school and health officials in the areas of hazard identification, supervision, and risk communication. Familiarity with CPSC guidelines was assured as the expertise in application of the CPSC document was demonstrated on playgrounds by those individuals who were trained. More training was requested by several health inspectors. Playground assessments were performed on 13 separate playgrounds located at 11 schools in the three counties mentioned. The assessments include a

detailed inventory of each piece of equipment, compliance checklist, and written reports and recommendations.

Groundwork laid for surveillance system

The beginning groundwork for developing a statewide school injury surveillance system was laid at a 3-day task force meeting in Olympia during the month of August, 1992.

An initial coalition was formed involving school districts, health departments, Harborview Injury Prevention Center, Crawford & Company Risk Control Services, DOH, Washington State University, and the Office of the Superintendent of Public Instruction. Subsequent meetings and tasks were identified and scheduled for years 2, 3, 4 and 5 of the grant. The U.S. Consumer Product Safety Commission and the Center for Disease Control sent staff to serve in an advisory capacity to the DOH playground injury prevention project. While recognizing that there would be particular attention to playground injuries in K-5 schools, the overall injury surveillance study was designed to pick up all elementary school injuries. This was reflected in the test hypothesis, investigation design, process, sample characteristics, sample size, methods of measurement, data management strategy, quality assurance plan, data analysis, outcome variables, and initial operations plan, which were submitted to CDC and subsequently approved. This study design was part of the proceedings taken from the injury prevention meeting held in October, 1992, and is included at Appendix 2-A.

A Playground Hazard Assessment Checklist was produced to replace the original, which was done before the 1991 CPSC playground handbook was published. The checklist is still being modified based on field test results and comments from users at the local health departments and school districts. The checklist is included as Appendix 2-B.

Data linkage between DOH, OSPI and other insurance companies was begun during the summer of 1992. Preliminary meetings with Industrial Indemnity Insurance, Crawford Risk Control Services, and the Puget Sound Risk Pool were conducted. Some loss figures were made available immediately at the Risk Pool, although they are proprietary and are non-publishable. The Superintendent of Public Instruction is planning to go to a paperless student information system over the next several years and is willing to examine the possibility of incorporating student injury information which can be supplied to DOH for epidemiological purposes as well as directly back to schools and insurance companies.

The criteria for selecting future school playgrounds to be assessed for hazards were developed. To be selected, schools needed to be located within the service area of school districts that were willing to consider participating in a pilot injury surveillance project. Second, schools needed to be willing to use the new injury report form. This form was designed to collect useful epidemiological information as well as traditional information useful to schools and their insurance carriers.

Third, schools had to be located in health jurisdictions that were or were trying to develop active school programs and were willing to commit their staff to the minimum playground safety training and other cooperative activities with the Department of Health.

The first draft of the Washington State School Playground Safety Plan Review Checklist was been developed. It was based primarily on CPSC and ASTM recommendations and guidelines. This checklist is included in this report at Appendix 2-C.

Three educational seminars were conducted in Olympia, Spokane, and Yakima. Over 100 participants and 20 speakers participated. The presenters and speakers included insurance industry executives, representatives of the Washington State PTA, architects, lawyers, school officials and health officials. The success of the seminars was good to excellent, according to the conference evaluations at all three sites. The overwhelming comment received was for the state to provide more training in all areas related to schools and develop new, comprehensive guidelines for inspectors and schools to use in interpreting safety hazards.

An audio-visual presentation was developed based on slides which were taken at the playground assessment and training sites across the state. The slides show hazards on playgrounds as well as supervision issues.

Federal Fiscal Year 1992-1993

During the month of January, continuing training in playground equipment inspection was provided to local health department staff in Cowlitz, Wahkiakum, Clark, Klickitat, Skamania and Thurston counties. Inspection reports and summary reports were generated for playgrounds inspected during the Fall of 1992. These reports were provided to Joe Smith, the CDC project officer, during his visit in February, 1993. Work simplification techniques were explored with Southwest County Health District staff member, Tom Eli, including using miniature tape recorders in the field as well as developing menu-driven field software to be used with notebook-style portable computers. This would have involved some capital and local funding assistance from CDC initially, but would have been more than recovered in two or three weeks of report-writing time, using the current hard-copy method. This idea did not move forward for budget reasons.

Also during this time the fourth school safety and health seminar was arranged for March 24, 1993, in Mt.Vernon. It was once again arranged to do the seminars with the assistance and support of the Washington State Environmental Health Association, the Washington State Trial Lawyer's Association, the Superintendent of Public Instruction, and the Washington State PTA, as well as five local health departments in the northwest part of the state. These departments were Skagit, Island, San Juan, Snohomish, and Whatcom. Additional speaker assistance was secured with Harborview Injury Prevention Center and the Bellingham School District.

During February the Snohomish County Health District participated in the project and became the sixth local health agency to receive complete training in playground equipment compliance and hazard identification. Mr. Thompson and Mr. Ellis team-taught this group, and Ms. Janice Fleisher and Mr. Rick Micklich were the principal environmental health specialists involved in arranging the training. Several other staff , including Chris Mullen, Rick Zahulka and Bob Hoppa, were also trained. After the classroom and field training, the section supervisor designated areas for each school playground inspector. There was previously no one in Snohomish County doing this. This represented a significant amount of time (and money) on the part of their department.

During the first week of April, Chelan and Douglas County environmental health specialists were trained for a full week in field recognition of school and playground hazards, including playground plan review. Health department staff members were already ahead of the instructors due to a one-day training the previous year in October. Therefore the training went beyond basic hazard recognition and abatement strategies and delved into proper design and plan review. A complete set of plans was reviewed and a letter written to the designer. A copy is included as Appendix 2-D, as an illustration of how badly playground plan reviews are needed and also to illustrate how fast environmental health staff adapt to this type of training. Bellingham-Whatcom Health Department also received full training on playground safety.

Work continued with the statewide task force to develop an injury reporting and intervention evaluation system. Two specific injury interventions were planned. One involved physically altering the playgrounds to make them safer by adding more surfacing and eliminating some of the hazards mentioned by the Consumer Product Safety Commission's playground guidelines. This was the "passive" intervention, similar to installing air bags on cars. The other intervention was "active" and involved improving the interactions between students and improving supervision by school staff. The first was more capital intensive, while the second required less capital but ongoing involvement in maintaining a safer school culture. These are discussed more fully in Section 3 (Injury Surveillance) of this report.

The injury reporting form was finalized and was used to train local school districts who decided to participate in the injury surveillance research project, which received funding for years three through five of the grant. The results of this research is discussed in detail in Section 3 of this report.

Staff participated in developing the American Society for Testing and Materials (ASTM) playground standards in Philadelphia and co-chaired the "falls and surfacing" subsection of the playground committee. A new emergency standard was approved and subsequently distributed by ASTM. The new standard had the effect of modifying and adding to the current Consumer Product Safety Commission Handbook for Public Playground Safety. Some of the elements in the new ASTM standard

were approved as a result of input from Washington State Department of Health School Program staff and school program manager.

As before, Washington was the only state with health agency representation on this important committee. It was observed during the ASTM meetings that there was a predominance of playground equipment manufacturers on the committee and sub-committees. This is significant because the ASTM committees did not then, nor have they yet adequately addressed problems related to maximum recommended equipment height, "functional linkage" equipment components in fall zones and adjacent play events being placed "too close together" on elevated decks of play structures. The Washington State Department of Health has strongly advocated that these and other significant items be addressed.

The Department of Social and Health Services (DSHS) day care inspection division received training in day care playground safety from Thom Thompson, the school program playground safety specialist. This training was funded separately, and it represented a significant playground safety capacity-building activity beyond the scope of the disabilities grant activities. This was a case of having the right person in the right place at the right time. Another benefit of this additional activity was the development of a day care inspection manual and checklist. The manual has been published and distributed throughout the state.

In July, 1993, Okanogan County arranged a meeting with its administration, board of health and staff. As a result of that meeting, Okanogan County agreed to start a school playground safety program and was trained in November.

Okanogan County also drafted new regulations governing schools in its jurisdiction. The director of Environmental Health, Mr. Charles Vaught, submitted his draft regulations to DOH for review.

The playground safety specialist assisted local health inspectors in Chelan County in a new playground plan review at Bridgeport. This was the first health agency playground plan review ever done in Washington. There was much discussion and correspondence with the manufacturer, who did not want to meet CPSC, ASTM or Washington State specifications. A pre-occupancy inspection of the playground was done by the program manager. The playground was never approved by state or local health agencies, however compliance and non-compliance on specific safety items was documented through this inspection. Local and state health staff were exposed to methods of communication and documentation of playground hazards to playground equipment manufacturers.

A presentation was made to the Washington State School Business Officials at their summer meeting. The entire school safety and health program was explained to them as well as the playground safety training and proposed research project. School business officials, as well as the Puget Sound Educational Service District were supplied with information, regulations, guidelines and handouts about the program.

The Washington State School Superintendent's Association was visited in Olympia by the school program manager, and a short orientation, accompanied by handouts, was given to staff. Former Association President, Norman Wisner, at Tumwater School District, agreed to have his school district participate in the injury research project.

Tacoma-Pierce County Health District established a School Advisory Committee during a meeting in August, at which the primary speaker was the school program manager. This is the first time in the state that a school program has established a formal advisory committee, composed of public and private school superintendents, local and state health officers, building officials, nurses, architects, and PTA representatives. Services that were available from the state and local health departments were explained during this meeting. This concept was taken from an idea that was put forth at the school seminar that was done in Olympia the previous year.

The University of Washington provided a student intern during the summer, who received training on playground hazard identification. The student was the President of the student Environmental Health Association, and indicated that there would be further activity between the Department of Health and the University's School of Environmental Health. The head lecturer of the school of Environmental Health, Mr. Chuck Treser, indicated that he was interested in working with CDC and DOH in developing some training grants which could be used to achieve public health objectives while providing training opportunities to students. The office manager, Karen Van Dusen approved this concept and instructed school program staff to explore this matter further in the future.

The Washington State Board of Health requested school program staff to prepare a 2 to 3 hour presentation on school children's health and safety issues for their meeting on February 9, 1994. This meeting went very well, and the Board of Health adopted six resolutions for DOH actions to be taken towards improving school children’s health and safety in all areas. These resolutions are included as Appendix 2-E. In summary the recommendations are as follows:

1. Survey local health on implementation of state school regulations
2. Develop a report on school indoor air best management practices
3. Advise the Board on the advisability of adopting CPSC’s playground guidelines and OSPI’s lab safety guidelines as state regulations
4. Prepare a safety guide for use during routine inspections
5. Report to the Board on the advisability of setting up school injury surveillance statewide
6. Make recommendations to the Board on revisions to the school regulations

The school playground program was selected by Grant County to receive funding for a part-time employee (.25 FTE) to perform school playground inspections. Training for this employee, Joe Vela, was done in early November. Playground site assessments were also performed at that time.

The school playground injury prevention project was included in the Washington State Injury Prevention Plan as well as in the state Disability Prevention Plan. These plans, while distinct, are complementary in the sense that they both set forth strategies to prevent negative health impacts which are costly and preventable. Being included in both reports was an indication that the project was viewed favorably from either and injury prevention or disability prevention perspective. School based injuries were seen as being related both to head and spinal cord disabilities as well as fractures and other injuries.

Inventories of school playgrounds were completed in Vancouver, at the Battleground School District. Six inventories were also done in the Wenatchee School District in Chelan County and four inventories were done in the Eastmont School District in Douglas County.

The playground project attracted the interest of another CDC grant which dealt with Environmental Health Indicators under an APEX grant. Playground injuries were separated from other "falls" injuries so that injury rates per 100,000 of state population can be separately tracked.

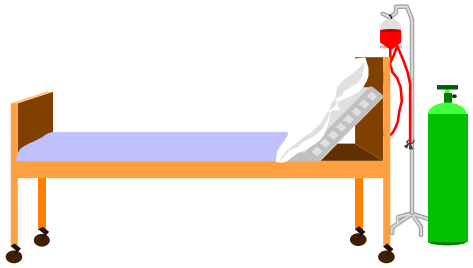
The Washington State Health Department was instructed by the legislature to draft a proposal called a Public Health Improvement Plan (PHIP) which included the agency's priority action items and related costs. ***The school playground injury prevention program was identified as a priority item*** and staff was asked to draft a proposal outlining the problem, the needs justification and the costs of program administration. This was submitted to department administration.

The program manager, in conjunction with injury prevention staff, identified three hospital E-codes which were used as a case definition for playground hospitalizations for children ages 5-12. The baseline data and the subsequent data through 1995 are presented in Table 2-2, below.

Table 2-2

Playground Injuries: 1989 - 1995
Washington State Hospitalizations
Washington State Residents Ages 5-12

Year	Number	Rate per 100,000 of State Pop.	Average Length of Stay (days)	Average Hospital Cost*
1989	206	37.3	3.33	$3,237.77
1990	178	31.1	3.51	$3,103.50
1991	212	35.7	3.04	$3,517.91
1992	248	40.5	2.44	$3,737.22
1993	153	24.2	2.82	$5,358.46
1994	147	22.7	2.31	$4,561.96
1995	118	17.7	2.39	$5,130.25



* Only cases where hospital charges were incurred were included in the calculations.

Data Source: Washington State Department of Health, Office of Hospital and Patient Data, CHARS

Playground injury identified as ICD-9-CM E884.0; E886.0; E917.0

Assessments of existing physical site hazards were performed at three to five sites in Snohomish County and 25 sites in Chelan and Douglas counties.

During the second year training of DOH staff continued to be provided by the playground safety specialist to the school program coordinator.

Cost estimates and/or proposals were obtained from Washington State University and Harborview to provide epidemiological and data support to this project, however both institutions cost estimates exceeded the available grant dollars available, so it was decided to do the work within the department of health.

The school injury surveillance form was circulated to epidemiology work group members, school districts, and CDC. Comments were reviewed and a completed form was developed by the grant manager and the school program manager.

The fifth revision of the Playground Hazard Assessment checklist was pilot-tested in local health departments. The form added a page for a schematic drawing as well as a five-year maintenance plan. A supervision section was also suggested by CDC, but is yet to be incorporated. It was suggested that pictures of individual pieces of playground equipment be taken during the inventory process, and these pictures could then be used by the schools in the sick room to assist in identification of specific injury sites related to playground equipment.

Federal Fiscal Year 1993-1994

Staff conducted seminars in Seattle and the Tri-Cities on school playground safety and other school issues for local schools, health departments and parent groups in geographically diverse sites.

Twenty nine sites were assessed in five local health departments, using the CPSC guidelines. Playground injury staff provided follow-up consulting services to three previously-trained local health departments. In addition, several local health departments used some of their own money from the state public health improvement funds to conduct playground and school inspections. This was a direct outgrowth of the training activities performed during the preceding years of the grant.

School personnel were trained by Disability Prevention Project (DPP) project staff with assistance from local public health personnel. Injury reports were received from all participating schools using the new reporting form. A preliminary analysis of injuries (tallied by hand) was completed using the data submitted from the participating schools.

The expected outcomes for the data management system were discussed with data management services, the disabilities and prevention team and the new grant coordinator. A list of potential questions for the data management system was developed. These questions were reviewed by staff at CDC and an injury epidemiologist at Washington State University.

The data collection efforts got underway in all the schools.

The Washington State Trial Lawyers Association conducted a state-wide media project on identifying playground hazards. This was done in conjunction with the CPSC and consumer groups.

Technical assistance was provided to Whatcom, Chelan Douglas and SW Washington Health Departments on playground plan reviews for schools and parks.

An initial draft of a Washington State Department of Health School Playground Design and Equipment Policy was prepared by DPP staff, who once again attended the March meeting of the ASTM Playground Standards Committee.

The project playground safety expert was selected as a reviewer by the Department of Health and Human Services, Maternal and Child Health Bureau for the playground section of “Caring for Our Children; National and Health Safety Performance Standards for Out of Home Child Care.” This document was published by the American Pediatric Association and the American Public Health Association.

Efforts to secure epidemiological oversight for the project were successful. James Gaudino, an epidemiologist from CDC was recruited through an Interagency Agreement. He started on July 1, 1994.

A "Surveillance-Intervention Committee" (formerly called the “Data-Epi Committee”) met to advise school staff on forms, design parameters, data analysis and intervention strategies. This committee included Superintendent of Public Instruction (OSPI), DOH, local school and local representatives as well as an epidemiologist.

Schools agreed to be trained by State Health staff in using the school injury report form and agreed to participate in the intervention evaluations on a random-selection basis. Schools were "matched" for appropriate epidemiological factors.

Report forms and/or disks were copied and distributed to schools, and the reporting was monitored, and reporting procedures were standardized in the field to the extent possible under the circumstances.

Site-specific equipment inventories were developed in the field by state health staff, who also trained school staff on equipment recognition and used pictograms on the new report form.

Staff completed data gathering for grant year three; began to analyze data and prepared a year-end report on these results which were to serve as a baseline the intervention study that was being developed. They also conducted site specific in-service training sessions, observations and reinforcements with local school staff. The state school program manager was also trained in supervision techniques as part of overall capacity building.

Staff worked with local schools, parent groups and playground equipment companies to modify sites. At the same time they supervised

plan development, plan review and some installation . The school program manager and local health staff were trained on all phases. Video tape recordings were made of each site for later comparison.

In Grant County one school district dropped out of the study at the last minute. However project and local health staff secured the last minute participation of two additional school districts, where two schools agreed to take part in the injury research project. Both sites were inventoried and assessed.

The project also continued to develop playground hazard identification and problem-solving capacity at the local environmental health level as has been done during the previous grant year. A key difference during this year, however, was that over half of the CPSC hazard identification training was conducted by department of health's own staff since the state department of health was fully trained on playground hazard identification.

This new capacity allowed the grant to be expanded in the direction desired by both CDC and DOH. With this capacity in place at the state level the expansion to the school injury surveillance project allowed documentation of specific school injuries. Based on preliminary results an intervention study was designed to assess the effectiveness of two fundamentally different interventions: 1) site safety modifications and 2) better supervision.

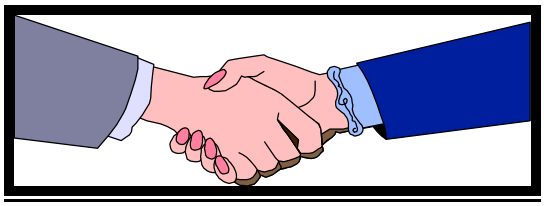
During year 3 of the project a major addition to previous capacity building activities and a change in emphasis occurred, as the goals became not only to build on the accomplishments up to that point in terms of training, but also to put in place a pilot injury surveillance program that would provide a systematic assessment of the magnitude of the problem and help to develop strategies that would reduce the frequency and severity of school playground injuries in Washington State. This project strategy was envisioned to include a partnership between the Washington State Department of Health, the Superintendent of Public Instruction (OSPI), parent organizations, local health departments and local schools.

> ***The basic roles of each would be for the Department of Health to fund training, technical assistance and policy development; Superintendent of Public Instruction to fund surveillance, research and record-keeping; LHD's to fund staff to perform hazard identification and write reports to schools; Schools to fund staff and site interventions and manage supervision and record-keeping staff; and parents to assist by financial support and help with site changes.***

This partnership is shown in Figure 2.1 below.

Figure 2.1

A Model for a Partnership to Reduce School Playground Injuries



DOH

- Training
- Technical Assistance
- Policy Development

OSPI	LOCAL HEALTH	SCHOOLS	PARENTS
♦ Surveillance ♦ Record-keeping	♦ Identify Hazards ♦ Assurance	♦ Interventions ♦ Surveillance	♦ Funding ♦ Site Changes

The projects goals were adjusted from mostly capacity-building to a balance of capacity-building and injury research activities. In the injury research area, state and local health staff, working with CDC and other epidemiologists on an advisory basis, undertook a series of specific actions aimed at accomplishing the following objectives:

1. Field testing of the injury reporting form.
2. Explore intervention study design options based on injury data collected and other epidemilogic and statistical considerations.
3. Secure commitments from 2-3 counties involving 12-15 schools at which the injury intervention study will be conducted.
4. Train the school personnel in correct injury reporting.
5. Measure injury rates and types at participating school sites.
6. Measure injury locations at participating school sites.
7. Develop a school injury data management system.

Interventions

8. Train selected school personnel (who were not part of the control group) in playground supervision procedures. (Intervention #1)
9. Assure that selected schools (who were not part of the control group) modify their playground surfacing to comply with Consumer Product Safety Commission guidelines. (Intervention #2)

SCHOOL RISK MANAGERS QUESTION ROLE OF PUBLIC HEALTH

It was significant that at both the Seattle and Tri-Cities seminars there were school risk managers present who questioned the authority and ability of health agencies to inspect schools. Apparently there were problems with inspectors in some areas getting off on the wrong foot with schools by using techniques and forms that were more suited to regulatory enforcement than to technical consultation and advice. This began what later became a statewide letter-writing campaign to the Superintendent of Public Instruction to eliminate comprehensive health and safety inspections in schools in Washington State. The four issues raised by the risk managers will be discussed below under year five activities..

The major deliverables for this phase of the school injury project reflect the completion of the "tools" needed to track injuries and the framework for the actual study of the interventions.

Federal Fiscal 1994-1995

Playground Injury Prevention Activities

During the year the playground injury staff evaluated four sites in Seattle-King, Tacoma and Mason Counties. Staff conducted two partial playground evaluations in Mason County during general school training. During August four more sites were completed during training in Benton and Franklin counties, where six staff members were trained. In May two playgrounds were inspected with the local inspector and four school officials.

An informal survey of local health departments was done to determine how many plan reviews and inspections of playgrounds have been conducted throughout the state since the beginning of the project. There were 508 school playground inspections done since the statewide training program was begun in 1992. This number included the counties

which already had programs in place, but the vast majority of the inspections were by counties which had never done them before, representing a substantial increase in injury-prevention capacity on school playgrounds statewide. In addition, 101 day care playgrounds were also inspected by local health staff.

A school seminar was conducted on May 18, 1995 emphasizing, as before, the need for schools, parents and local health to work together. The seminar was well-attended, however there was some displeasure expressed by two risk managers over duplication of inspections.

Between May and October of the 1995 presentations were made by project staff to the following groups:

1. The Council of Education Facility Planners
2. Washington Association of School Maintenance Officials
3. Washington State Board of Health
4. Washington Association of Environmental Health Directors
5. School Risk Managers
6. State PTA

As a result of the Washington State Board of Health Resolutions, a workgroup made up of DOH and OSPI was formed to report on costs and benefits of enforcing CPSC guidelines as they relate to playgrounds.

Project staff again attended the ASTM Subcommittee on playground falls and equipment at the ASTM meeting in Philadelphia where the new ASTM standards were finalized.

The Tacoma School Advisory Council met several times, and King County staff received training in five of their districts from the school program manager. Jefferson , Mason and Clallam counties were trained during this period and staff assisted local health inspectors on playground designs in Spokane, Jefferson, Chelan, Okanogan, Snohomish, and Seattle.

Federal Fiscal Year 1995-1996

Two seminars were held in September, one in eastern Washington and one in western Washington. These seminars focused on playground injury prevention, other school-based injuries and other issues.

In previous years, the School Program Coordinator had trained local health officials in playground inspection The Department of Health therefore initiated actions through local health jurisdictions to undertake assessments and document safety hazards on school playgrounds at school sites, independent of DOH staff.

The counties involved in these assessments submitted copies of their hazard assessments to DOH, which in turn forwarded copies to CDC. These reports were reviewed for completeness at the State level by the School Program Coordinator. This demonstrated the competence of

participating local health agencies in using the most recent CPSC Handbook and ASTM Technical Standards.

Staff continued to attend and give presentations at state and national injury and disability conferences, including at CDC headquarters, the Washington State Joint Conference on Health, and the Washington State Environmental Health Association. Several "Powerpoint" presentations were prepared which are submitted as Appendix 2-F. Planning for publishing professional papers was begun.

State School Facilities Committee

As a result of increased activities, including inspections, by local health agencies and attempts by some of these agencies to recover their costs through inspection fees (which had not been agreed to by the school districts), legislation was introduced in the Washington State Legislature to curtail the ability of health departments to recover their costs in that manner.

From April of 1995 through October of 1997, representatives from several state agencies (DOH, OSPI, L&I) and from a variety of public and private school interests have been meeting as a committee to review and discuss the issue of school facility health and safety.

This committee was convened as a cooperative effort between the Department of Health (DOH) and the Washington Association of School Administrators (WASA). The principal task was to address concerns raised in proposed legislation that would place a cap on the fees that local health agencies could charge to K -12 school districts for performing health and safety inspections. In early discussions, it was determined that the issue would be addressed in three areas; financial aspects, jurisdictional roles and responsibilities, and standards and guidelines for facility health and safety.

Finance: The committee recognized a number of financial factors that effect school facility health and safety, and the impact of school facility inspections. These include the direct expense of repairs and upgrades that may be identified during health and safety reviews; the liability exposure to the school if hazards are identified, uncorrected, and injuries occur - or to the inspecting agency if hazards are recognized but ignored, undocumented, and injuries occur. Regarding the item of legislative interest, fees, the committee recognizes the following:

- School inspections by local health departments are not consistent in quality and frequency, nor is there a coherent statewide reporting of injury/illness reporting in schools. Both of these situations inhibit the development of both a clear needs-assessment and a detailed cost-benefit analysis which would help determine whether public health and safety services are needed in K-12 schools.
- The primary funding source pursued by most local health agencies is user fees, and the trend is increasing in that direction.

- There is a high degree of variability among local health jurisdictions regarding fees and levels of service.
- The initial funding category available to schools (Non Employee Related Costs) to pay for inspection services was developed years ago and is inadequate to cover the complexity and costs of contemporary school facility safety concerns.
- Generally, any costs incurred as a result of safety inspection requirements are drawn from routine operation and maintenance budgets, further reducing the facility manager's ability to operate and maintain the facility.

Jurisdictional Roles: The committee quickly became sensitive to the number and complexity of agencies and rules that apply to public and private K-12 school facilities. A matrix was developed (see Appendix 2-G) to identify these roles, and to use in looking for overlap, duplication, and redundancy. Our immediate observations are that it is often unclear who administers federal requirements locally, that some actions, such as self inspections, are not required by any code but reinforced as good business practices, and that confusion or conflict can exist between some agencies' specific code citations other agencies' overriding purpose to "protect the general welfare."

Standards and Guidelines: The committee has spent considerable energy on evaluating the array of technical standards and compliance guidelines that exists. An effort has been initiated to develop a uniform inspection checklist with specific technical and legal references. A recommended protocol for the interaction between the facility and the evaluating agency was developed (see Appendix 2-H), patterned after the one used by the State Auditor. A mechanism to prioritize needs and risk of hazards is included in that protocol.

Consensus Obtained: On several crucial issues, the committee members agree. All parties care about the health and safety of the children and staff in these facilities. If fees are negotiated for inspections, these fees should only recover the actual costs of services. Fees should not be used to support other, non-school related programs within the health department. The parties do not agree on an exact formula for local fee setting. But, all parties agree that neither school districts nor local health agencies have the funding to evaluate and upgrade facilities as needed. The health and safety of public and private schools is, to a great extent, a public good and the beneficiary is the general public - public funding to assure that schools are healthy and safe environments for children is therefore appropriate.

Next Steps: There are several actions to be completed, technical, financial, and potentially legislative. Work will continue on the safety guidelines and the roles and responsibility matrix, and these will be integrated with the inspection checklist, so requirements are clearly articulated in terms of performance and authority. The DOH will continue work with local health agencies on improved use of fee setting methods and procedures. The work of this group will be incorporated into

upcoming presentations from the DOH to the Washington State Board of Health regarding the status of local inspection programs and school facility health and safety. The committee itself does not intend to pursue or support legislation, but will be available to respond to legislative inquiries on what progress has been made and what remains to be done. Individual members of the represented organizations may pursue their own legislative action independently of the findings or recommendations of the School Facility Health and Safety Steering Committee.

BEFORE AND AFTER CAPACITY BUILDING

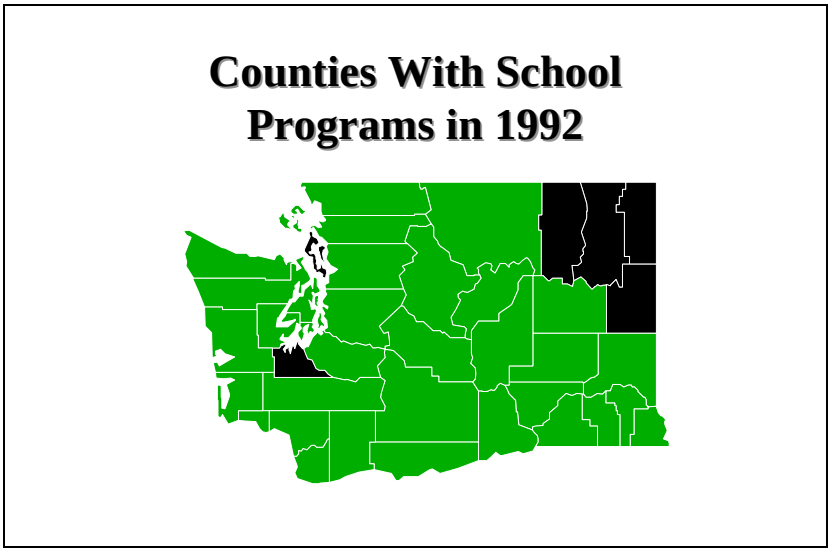


Figure 2.2
1992 Counties With School Safety & Health Programs

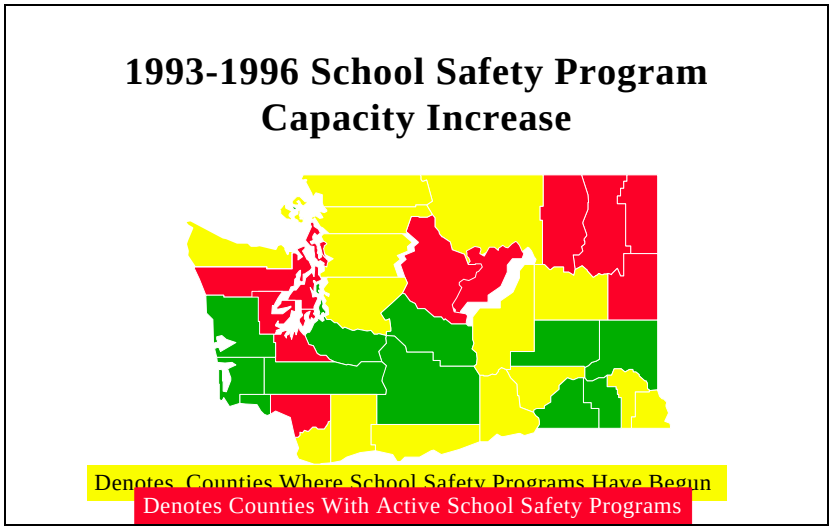


Figure 2.3
1997 Counties With School Safety Programs Either Established or in the Development Phase

As mentioned earlier, when the DOH school safety program began in mid-1992, there were only 5 counties (see Figure 2-2) that conducted activities beyond complaint response and food inspections in schools.

Injury Rate Decline on Playgrounds

Since 1992, when the school playground injury prevention program started, there has been a 56.3% reduction in elementary school age children's' playground hospitalizations in Washington State. This compares to a reduction of 11.4% for all unintentional injuries requiring hospitalization during the same period. Whether the greater rate of reduction for playground injuries is due to chance, implementation of CPSC and ASTM guidelines or some other cause(s) cannot be derived from existing data. Nevertheless, the results are encouraging.

This concludes the chronology portion of the capacity building report.

DEVELOPING SCHOOL SAFETY PROGRAMS IN WASHINGTON STATE

The following sections are taken from the training materials used by DOH staff to familiarize local health staff with the school safety and health program. It provides the background for developing a playground safety program in Washington State.

Training Local Health Departments on Playgrounds

Training local environmental health specialists in playground safety requires that they be provided with the tools and the knowledge to measure playgrounds and determine compliance with CPSC guidelines and ASTM standards. It also requires that DOH and local health staff learn about the school system, their culture, the budget cycle and about how and why children play. The next section deals with what was and is taught to local health in order for them to have the capacity to effectively work with schools, park departments, day cares and other private and public facilities to achieve not only safer but better playgrounds from a child development perspective.

Before a local health department is trained, there must be agreement as to what will be taught, and over what period of time. The schedule for training is mailed out to the health department several weeks or more in advance of the training to be sure there are no misunderstandings.

Training Curriculum Outline

First Day - Morning

- Orientation to statutory and constitutional authority for safety inspections on school playgrounds.
- RCW duties and responsibilities of local and state boards of health compared and contrasted.
- New injury prevention role of DOH as delegated during 1989 legislation session creating the "new department of health."
- Explanation of WAC 246-366 site review and plan review sections as they relate to playground safety & design.
- Explanation of WAC 246-366 safety section as it relates to school playgrounds.
- Discussion of Washington State Attorney General's 1990 informal opinion regarding the school program's "enforceability."
- Answer staff questions regarding CPSC playground manual.
- Explain in detail all playground vocabulary and concepts.
- Instruct staff on how to use draft DOH playground checklist. Explain scoring system & site diagram.

First Day - Afternoon

- DOH staff perform assessment on typical older wooden structure playground; explain general procedures and demonstrate field equipment.
- DOH staff make site drawing and explain playground inventory process.
- Instruct local staff on basics of hazard identification from both a safety engineering and risk management perspective.

Second Day - Morning

- DOH staff perform assessment on typical older metal and wooden structure playground, focus on typical hazards and identifying hazardous play patterns.
- Demonstrate anthropometric differences between equipment designed for 5-7 year-olds and 8-12 year olds. Perform specific measurements for string entanglements, grip diameters, slide angles, entrapments, angles and protrusions. Have staff perform duplicate measurements and take pictures of staff for use in presentations.

Day Two - Afternoon

- DOH staff perform assessment on typical newer school playground. Compare and contrast hazard patterns and similarities to older playgrounds.
- Instruct local staff on school facilities manager and risk manager's different roles. Demonstrate with flow-chart and diagrams how purchasing is handled and how work orders are prioritized. Instruct staff on techniques needed to interface with principals, parent groups (PTA) budget directors and superintendents.

Day Three - Morning

- Local and DOH staff perform assessment on playground chosen by local health staff. Break into small groups or one-on-one instruction.
- DOH staff answer specific questions and discuss/correct small group's findings, as needed.

Day Three - Afternoon

- Local staff selects and performs assessments on local playgrounds. DOH assists when needed and reviews results.
- Questions/comments on draft form.

Three Days of Training Required

Playground injury hazard identification and scoring requires specific knowledge of dozens of injury patterns, children's developmental stages, and learning a whole new terminology. This takes three days. To do less than three days would put people in the field with inadequate knowledge and skills to do an inspection that would withstand the scrutiny of the school district's staff. This is not based on our opinion, rather it is based on the feedback we have received from health department staff from Snohomish, Chelan-Douglas, Whatcom, Cowlitz, Thurston, and Southwest Washington. Staff in all these counties have told us one or two days won't do the job.

SCHOOL REGULATIONS

Practical Tips for Using WAC 246-366

The following section was taken directly from a training handout used by DOH trainers.

Common Law Concepts

State and local courts have jurisdiction over schools. There is no U.S. Constitution provision to educate children, thus generally there is no federal cause of action. (Exceptions: integration and religion cases). State Board of Health WACs derive their authority from U.S. and Washington Constitutions under police power clauses for "general safety, health and welfare" of citizens.

Public schools were started by the Catholic parochial system in New York and grew in the U.S. after the Civil War.

Child labor during Industrial Revolution (circa 1805-1900) delayed and slowed the growth of public school systems (states perceived a duty to prevent vagrancy and youth vandalism and idleness). In 1932 truancy laws and mandatory K-6 education laws were passed - education became compulsory

Property Issues

The duty of care is to inspect for unsafe conditions and to repair known defects or those which should reasonably be known. Students can have status of "invitees", "business invitees" or trespassers, depending on the circumstances. Schools, as property owners, have ultimate responsibility for safety on the school premises. Statutes which require others to inspect schools for specific safety or health problems do not relieve schools of their overall premises liability responsibilities.

Inspection reports put school districts on notice of unsafe / unhealthy conditions. Once a hazard is known to exist it is the school's duty to repair it, or in the alternative, separate the children from the hazard if danger is imminent; otherwise specific facts determine what reasonable action must be taken.

The Law of Agency

The "master" (employer - school district) is liable for the tortious acts of any "servants" (employees -teachers, etc.) for acts committed during the "scope of employment" - this includes most "unauthorized" acts - employees remain liable also - In some cases *indemnification* may be owed by the employee to the "master".

Tort Law

The duty of care for schools is that of a "reasonably prudent person" in similar circumstances.

No special duty is owed - and there is no "per se" negligence.

The burden of proof is on the plaintiff to show the negligence of the school district. Schools have a duty to maintain and repair their premises under State BOH regulations (Sections 040, 050, and 140) and OSPI

rules. Attendance is mandated for children ages 8-15 and schools take the place of parents during this time{ “loco parentis” (“custody”) doctrine}.

As a general rule: a tortfeasor is responsible for his torts.

Former exception: RCW 28.58.030 precluded liability to districts or agents for non-contractual acts or omissions on playgrounds, athletic apparatus, and machinery.

However , RCW 4.08.120 and 92.090 established liability for states and municipal corporations (school districts) - i.e.: no more “sovereign immunity” was allowed for school districts. This is part of the reason schools are so concerned about liability.

Statutory Authority

The powers and duties of the secretary of DOH is located in **RCW 43.20A.600**. This law provides for investigations into the effects of environment and other conditions on public health. It also provides for enforcement of BOH regulations, including doing the local Health Officer’s duty if he/she fails or is unable to perform them.

Local Boards of Health have the power to supervise all matters pertaining to the preservation of life and health of the people within its jurisdiction.{RCW 70.05.060}.

Local Health Officer’s have the duty and power to enforce the State Public Health statutes including prevention of dangerous diseases and abatement of nuisances which are detrimental to the public health.{RCW.70.05.070}.

Schools in Washington were initially regulated by the Washington State Department of Public Health. Report forms put the initial date at around 8/46, in Eastern Washington, for local health department inspections of schools. Early laws date back to territorial days and Remington Statutes.

WAC 248.64 (subsequently renumbered as WAC 246-366 {See Appendix 2-H}) was codified in 1960, and revised in 63, 71, and 82.

On June 8, 1971, the regulations on school siting (040) inspection (050), buildings (060), water supply (070), toilet facilities (080), showers (090), sewage disposal (100), ventilation (110), heating (120), lighting (130), heating (140), and food handling (150) were repealed by State BOH Order #55. The new sections dealing with these same areas were renumbered under our current WAC numbers and went into effect.

Amendments in July and September of 1973 followed. These 1971-3 WACs were meant to be both more comprehensive and more specific as to what schools had to do. Enforcement guidelines for Environmental Sanitation (see appendix) were developed in 1973 by DSHS Health Services Division to provide clarification and interpretation of the rules and regulations. Furthermore, the “Interpretive Guidelines” as they were called, provided suggested methods, materials, and examples to help schools comply with the regulations.

During the “70”s, the growth in the number and scope of administrative agencies such as Labor and Industries, WISHA, local building, fire, and plumbing codes, and so on, brought overlap and confusion into the school regulation arena, In an attempt to eliminate some of the conflict, the school regulations were changed in March of 1982. These are the regulations we are using today, with the exception of new provisions on noise, which were added in 1989.

There is no comprehensive compilation of interpretive guidelines to accompany the 1982 regs, although in 1989 an amendment to the noise and school siting regulations was approved by the State Board of Health and sent to all Washington health departments. Old guidelines, where still current, may still serve as a basis for making recommendations. They can also be used as examples for schools. Caveat: Be careful not to reference repealed or outdated portions.

The Statutory authority for allowing the State BOH to adopt school environmental regulations is found in RCW 43.20.050(2)(c). Heating, lighting, ventilation, restrooms, cleanliness, and space requirements are specifically mentioned, while “safety” is not.

Language does not include, “...including, but not limited to” language.

The RCW was passed for the immediate preservation of the public peace, health and safety. Thus, the legislative intent was not to exclude the safety of children from the Board of Health’s regulatory authority. The World Health Organization has stated that all aspects of a person’s physical, mental, and social well-being are included in a “healthy” environment.

Public Nuisance

Nuisance theory of public health is an area to be aware of when addressing safety problems on school property. Schools face liability exposure if their properties contain public nuisances. “Public” nuisance may be construed from general access to playgrounds, buildings, etc., within a neighborhood. (RCW 7.48.120,130,140).

This theory can be persuasive to school districts to whenever there are obviously unsafe conditions on school property. Such conditions do not have to be codified, they merely have to be observably dangerous to reasonable adults. Children are not held to adult standards, however, and are not expected to be able to discern dangers that are obvious to teachers, parents, and inspectors.

Schools do not need to be threatened. They are aware that they may be liable for injuries occurring on their property, whether you write it down in an inspection or not. A school inspector’s function is to bring unsafe or unhealthy conditions to their attention. You can point out that if a child is harmed or killed due to such a dangerous condition, their parents or estate might use a nuisance theory as one potential avenue to attack the school’s insurance policy. Such risk exposure to the districts could result in paying higher premiums and take valuable resources away from

education dollars if a child were to be hurt. The costs of effective prevention methods, which also takes money away from education, needs to be balanced against the risk of having to pay for a serious injury or injuries. (**Prevention has been found in many cases to be a much smaller cost to school districts, and is consistent with good public stewardship of school property. It also is part of the mandate of the public trust and meets the compelling state interest to provide a safe environment for K-12 public schools**.)

Enforcement

All local Boards of Health, officers of state institutions, police officers, sheriffs, employees of the state, cities or counties shall enforce all rules and regs. of the State BOH (RCW 43.20.050(3).

The schools regulations. (246-366) do not contain specific enforcement provisions. This is one reason why some confusion exists among some health inspectors.

Rules passed by the State BOH must therefore be enforced in most cases by DOH at the request of the local health officer. (RCW 43.20A.655) The law provides for any civil proceedings allowed by Washington Law.

Injunctions and special proceedings are specifically authorized to DOH in RCW 43.20A. 650.

DOH interpretive guidelines such as those written to clarify the 1971-73 regulations which have not been repealed or superseded by the agency or the BOH may still be used for their original purpose of clarification. The document does not have the force of law. It merely states the agency's professional opinion as to the intent of the BOH and the legislature. The DOH opinion is given great weight in court.

Enforcement guidelines, such as those developed by DOH and OSPI under WAC 246-366 (Safety) are no more than suggested practices. The purpose of having safety guidelines is so that as our profession adapts to changes in society, the agencies can revise the guidelines accordingly. This saves the time of having to go back to the legislature or the BOH.

Where non-imminent, but potentially serious safety problems exist, the Health Officer has the duty to give written notice to the school administrator and the local board of education (WAC 246-366-140).

This WAC provision applies equally to all inspections, but most school reports and follow-up consultations are routinely done with mid-management department heads. Work with them first on safety issues. Only go over their heads if they are uncooperative, and even then only with your Health Officer's approval. Be sure the issue you are dealing with in such situations is an important health or safety issue (i.e.: One that will not make you look like an idiot on the 6 o'clock news).

You cannot enforce a guideline. All you can, and must, do is document the problem, set forth what your agency considers to be some acceptable solutions, and notify the school authorities. Then, in writing, ask for their written response.

You may, by board rule, go as high as the school board with any "required changes and recommendations" (WAC 246-366-040). Let your Health Officer go to bat for you and possibly your local BOH. Even though you cannot enforce a guideline, you get notifications of hazards entered into your agency's public school files and into the school district's records. Do not be overzealous about this. You should be very sure of what you are writing before you make an issue of it with a school district. Generally it is a very good idea to research the specific hazard or health issue and find examples of how and when it has been a problem. For example, using data from the national electronic injury surveillance (NEISS) system or other surveillance systems can supply evidence to support the need to place protective surfacing beneath playground equipment. This sort of educational approach will often make any heavy-handed regulatory approaches unnecessary in school settings.

On the other hand do not be afraid to stand up to school staff when they are wrong. No one likes to be inspected and have something found wrong, but then again no one is perfect either, and people who inspect and maintain schools on a daily basis are no exceptions to this. They sometimes miss the most obvious things that a fresh set of eyes will see. This is perhaps one of the most valuable functions you will perform as an inspector.

But - don't try going to court to enforce a guidelines unless there is an imminent hazard to the health and safety of the students. This will take your Health Officer's special powers and should be used only in the most high-risk situations.

Current scientific or medical evidence can be used to support an argument in favor of your position in recommending a guideline, but the absence of a statutory mandate prevents us from using a "best available technology" approach.

The "violations-remedies and penalties" section under RCW 70.05.120 only applies (in the school context) to persons who violate health laws aimed specifically at the prevention, and control of dangerous, contagious and infectious diseases. In most cases this will not be applicable to school violations under WAC 246-366. If such is the case, however, the burden of proof is very difficult for your health agency since it is a criminal misdemeanor, not a civil action. The standard is "beyond a reasonable doubt" (90% +/-) instead of "a preponderance of the evidence" (>50%).

Nuisances and Public Nuisances - (Also see above section)

A nuisance is an act of omission which endangers the health or safety of others (among other things) (RCW 7.48.120).

A public nuisance is a nuisance that affects the whole neighborhood of community. (RCW 7.48.130).

The remedies for a public nuisance are civil actions (7.48.200) and may be brought by public bodies or officers (7.48.210) or in some cases by private parties (7.48.210).

It is possible that an unsafe playground or apparatus on school grounds may be characterized as a public nuisance if it can meet the above tests.

The normal course of enforcement is administrative.

Follow normal “notice and hearing” procedures and exhaust all internal administrative procedures. MEET WITH THE SCHOOL STAFF AND ADMINISTRATORS FIRST! If an impasse is reached with staff due to a difference of opinion, conflict of rules/guidelines or absence of an applicable standard, notify the local school district’s board of education about the specific problem. Explain all points of view as factually as possible, and advise them about any research you have discovered to support your position. The State Board of Education can also help in getting local school boards to address problems.

Only in extreme cases should court action be used. It is the last resort, and usually means communication and consultation by the health department has been ineffective.

Private Schools

The City of Sumner v. First Baptist Case

In February of 1982, the Supreme Court of Washington ruled on a case which said specifically that building codes and zoning ordinances (and school regulations by implication) could not be enforced against parochial schools even to protect the public’s health and safety unless the state could: 1) show that there was a compelling governmental interest; 2) that the rules being enforced related to that interest, and; 3) that the rule was the least restrictive means of achieving the compelling interest.

The reason given is to protect the 1st amendment, religious liberty.

The burden on the government is practically impossible to meet, thus, the parochial schools will be able to contest and win most cases where health, building, and zoning code violations exist.

The dilemma here is that this case sets religious schools apart from secular schools, and is arguably a violation of the Establishment Clause of the U.S. Constitution. Washington may be the only state in the U.S. that has required the government health and safety rules to meet such a strict test.

The bottom line at present for church-related schools is, “use common sense and negotiate using reason, not rules.

Tips For School Inspectors

Definitions

- *Introduction and Definitions*,(sections 010 and 020).
- Rules establish minimum standards, not optimum.
- The HO of "authorized representative" is charged with enforcing regs.
- Schools are both public and private (K-12). Where there is overlap (e.g. : day care), make copy for overlapping agency and request copy of their reports.

Site Approvals, Plan Reviews, and Inspections

Site approval, plan review, and inspection (040 and 050)

- Additions, new construction and (major) remodeling require written approval beforehand. If schools don't comply they are breaking the Board of Health rule.
- Plans can be rejected if they are not in compliance with WAC 246-366. Plans cannot be rejected for failure to comply with guidelines.
- Practice tip: Send a letter to the school district administrators in your jurisdiction alerting them.
- Plan reviews should be done using the existing DOH checklist to ensure that all major topical areas within the regs. are addressed.
- Practice tip: Wherever possible, make arrangements to review the plans in the presence of the lead architect or mechanical engineer in charge of the project. Do not be intimidated by blueprints. Ask questions and learn the ropes.
- File your plan review requirements letter and attach the checklist to establish a record of your actions.
- Follow up your plan approval with a pre-occupancy (or in many cases) a "post construction" inspection. Consult the architect beforehand to determine whether any significant "change orders" went through during construction, where applicable.
- Periodic inspections are required of schools**.** The State BOH has not said what "periodic" means(RCW 70.05.120), however in previous regulations it was once a year.
- The authority has been delegated to the local health officers to decide this. Establish a policy in your jurisdiction as to what "periodic" is. Annually has been recommended by DOH guidelines for 20 years or more. **But less frequency and better quality may be a good trade-off for understaffed counties**. There is no requirement that all counties be the same. That's why

the BOH made the delegation to the locals, not the State as to who is making this "judgment call". However, if the counties shirk their duty under the statute, the State BOH can bring an administrative action to remove the local health officer for failure to enforce the BOH's school regulations.

- Playground plan reviews are included under the plan review portion of the school regulations since they playgrounds are part of the school facilities. They are also the site of a significant number of injuries to children and are not well regulated elsewhere by building code, architectural standards or labor and industries. Playgrounds should comply with all ASTM standards and CPSC guidelines.

Buildings

Buildings (WAC 246-366-060)

"Buildings kept clean and in good repair" is a good place to document building deterioration, roof leaks, and so on. This section is similar and parallel to school district's existing duties under Board of Education regulations. Use this to help document poorly maintained or deteriorating facilities. Remember that these facilities may owned by the schools, but they belong and are used by everyone. They are a public asset and must not be allowed to fall into disrepair. Maintenance budgets have been steadily shrinking over the years in school districts, and in many cases this fact is reflected in the condition of the buildings. Do not hesitate to document your findings, since they will in most cases be visible (obvious).

Plumbing & Water Supply

Plumbing, Water Supply and Fixtures (WAC 246-366-070)

- Refer plumbing questions to local building department. When in doubt, call. The local building code department has primary responsibility, but we are the only health agency that is charged with "periodic inspection".
- State water WACs (246-366) apply to school water systems. Contact local DOH engineer and have updates and periodic checks done for compliance. Information should already be available in most areas by contacting the DOH office.

Sewage

Sewage Disposal (WAC 246-366-100)

- Sewage issues arise wherever schools are being built or remodeled. Get records of existing on-site systems and go over enrollment projections, landscaping, and paving plans with architects. Be sure to have permits.

- Check with planning, engineers, etc., before permit is issued.
- A pre-construction conference with all agencies and project architect is a useful tool prior to construction (and before permits are issued).

  Note: Once a permit is issued in error and the permit holder relies on it to his/her detriment, the issuing agency may be liable for damages sustained as a result.

Ventilation

Ventilation (WAC 246-366-110)

- No one has defined what "excessive heat" is. But pediatricians and energy codes have all suggested anything 80 degrees or above is out of line in a classroom full of children. More importantly, ASHRAE Standard 55-1992, Thermal Environmental Conditions for Human Occupancy, have been accepted by the school and public health community as a design goal for temperature ranges in schools. In winter the recommended temperature range is 68 to 75 degrees, while in summer the range is 73 to 79 degrees F. In Washington State some areas cannot achieve these recommended temperature ranges without air conditioning (mechanical cooling). Sub-adolescent children do not have well-developed sweat glands and can faint in excessive heat. If you suspect or learn of excessive heat problems in your schools, especially in the eastern part of the state, you may want to survey your school principals as to where the "hot spots" are in their schools, and exactly how hot does it get.

  Teachers, custodians and/or facilities staff can assist in this if they choose. Once you have some useful information, develop a report for the district and submit it to them with a cover letter explaining the methods and concerns you have, along with any suggestions for mitigation you may wish to make. These should be discussed with facilities staff in advance, if possible. You may or may not wish to request a response as to how they propose to deal with the situation(s).

  Remember that school diagnostic tests are often done in September, and achievement tests and finals are in May and June - during the hottest months of the school year. Be a student advocate - their health is (y)our business. Kids are very susceptible to heat. Temperatures over 80 degrees have been reported to affect some of them adversely ("faint, dizzy, sleepy").

Heating and Temperature Control (WAC 246-366-120).

- Minimum temps of 60 and 65 are easy to maintain in most cases. *Practice tip*: Automatic controls on HVAC systems are only required on schools built or remodeled after 6/8/71.

Sound Control (WAC 246-366-110).

- Promote the use of ear protection for everyone using shop equipment. handout on learning)

Lighting (WAC 246-366-120)

- Watch out for shadow zones in between lights.
- In some schools they have set up tutorial and computer areas in places (halls, stage areas, etc.) with improper lighting. Just because there is no prior history of bad lighting doesn't mean there aren't new problems.
- In non-air-conditioned schools one of the teacher's favorite tricks is to turn off the lights. or one row of lights in the afternoon. This is often due to excessive room heat, fatigue, and headaches. The reduced lighting also "calms down" the kids. Work with management to have visually-dependent tasks done with <u>all</u> the lights <u>on</u>.

Food Handling (WAC 246-366-130)

- Use the DOH red and blue form for school kitchens - this will help standardize your techniques and make results comparable to food program statistics.

Safety (WAC 246-366-140)

- Refer to DOH(DSHS)-OSPI official safety guidelines. 1. The "existence of <u>unsafe conditions</u> which present a potential health hazard to occupants" are in violation of these regulations.
- Any condition which is dangerous, unsure, or presents a possibility of risk or danger, is an "unsafe condition".
- A "potential health hazard" is any <u>possible</u> (as opposed to actual) exposure to danger or harm which could either impair the soundness of a person's body or cause a disease or ailment.
- Abatement of potential hazards should be prioritized in keeping with the assessed probability of injury and the seriousness of the potential harm.
- School districts should be asked to respond in writing as to when they propose to abate the potential hazards noted in the inspection report.
- Departmental follow-up is needed to determine compliance.

Exemption (WAC 246-366-150)

- State BOH retains power to relax rules if: 1) undue hardship, and; 2) no adverse "health or safety" effects will result.

- Procedure for requesting an exemption:
- The “owner” must request the exemption. Requests by architects, engineers, or other similar agents will not be considered, officially.
- The request is to be submitted to the secretary for the State BOH.
- The request must address which WAC is involved, how the exemption will not adversely affect the health or safety of the children, and why the school would experience an “undue” hardship if the exemption is not granted.

SCHOOL PLAYGROUND SAFETY- BACKGROUND

One of the basic assumptions that parents have when they send their children to school is that their children will return home in the same healthy condition as when they were sent. In many instances, however, this turns out not to be the case.

The 1991 Consumer Product Safety Commission (CPSC) Handbook on Public Playground Safety states that there are 120,000 "serious injuries" a year from public playgrounds, including schools, parks and other facilities. The CPSC figure only counts those injuries that resulted in admission to a reporting hospital. However, the vast majority of playground injuries are never reported since they are treated by school staff or parents, in doctor's offices or outpatient clinics.

In 1990-92 school playground injuries caused 1,138 hospitalizations among children 10-17 years of age in Washington State. From 1989-1995 there were 1262 hospitalizations of children between the ages of 5 and 12 from playground injuries in Washington State. Children in that age group are more likely to be injured at school than anywhere else. By applying the crude injury rate of 17 injuries per 100 student years which was found in the current study, there are over 85,000 injuries to the approximately 500,000 students in Washington’s elementary schools every year. The cost of these injuries is unknown, since there is no dependable reporting mechanism in place. Most injuries to school children are paid for by their parents, the parents’ health insurance, or Medicaid. Since non-hospital admission injuries to children at school are not kept in a centralized database, the health care delivery system and public health agencies know less about the injury causes and costs to this group than to any other large identifiable group in our society. Only a few states have started documenting all school injuries, and only one, South Carolina has for the last few years kept track of both serious and minor (school first aid) injuries.

Research into school injuries in the Pacific Northwest has documented high rates of injury to children in playground settings. In Oregon, the Beaverton School District found that 60 - 80% of the 12,000 elementary school injuries reported were from the playground recess period. A

surveillance study done in Tacoma, Washington found that 41% of all K-12 student injuries and 79% of elementary school injuries occurred on the playground. This rate was nearly three times as high as the next most frequent school injury location, gymnasiums. In Vancouver B.C. 24% of the reported playground equipment injuries were associated with equipment, compared with 40% in Tacoma. In Tucson a rate of 8.9 playground equipment -related injuries per 1000 Student-Years was reported compared with 8.1 in Tacoma.

Causes of Injury

Playground injuries are a common source of injuries in children.' Most of the data in this area comes from studies of public or school playgrounds, including daycares. While one study implicated falls from trampolines as a major injury producer on playgrounds, others have implicated freestanding slides, swings, climbing devices and equipment over heights ranging from 1.6 meters to 8 feet tall. One study has found that playgrounds with rubber surfaces had an injury rate one half that of bark surfacing and one fifth that of concrete. (Mott et al. 1997).

In this study, of forty school playground play events, four types of equipment (tire swings, horizontal ladders, dome climbers and "spinner bars") accounted for 40% of the equipment-related injuries, with remainder being distributed over the remaining 36 pieces of equipment.

Identifying injury causes is the key to supplying direction to solving playground injury problems. It is crucial to keep injury causes in mind whenever initial playground construction, remodeling or additions are planned.

State Board of Health Responsibility

The Washington State Legislature delegated the responsibility for school children's health and safety to the State Board of Health. The Board is required by statute to write rules governing virtually every aspect of K-12 school health and safety for students and other building occupants.

DESIGNING PLAYGROUNDS WITH CHILDREN'S SAFETY IN MIND

(Adapted from articles and materials previously published by Thom Thompson, Playground Safety Specialist)

The design of a playground seldom receives the same detailed consideration as other school facilities. Just as an architect designs buildings to meet the needs of the users, so should playground designs specifically address the development, play interest and learning needs of children. The Department of Health recommends separating K-6 children into age divisions of five through seven and eight through twelve based

on developmental and anthropometric data. This is consistent with the research done by the ASTM playground committee.

Play areas should be nearly level, yet well-drained. Standing water creates both health and safety problems. It creates slipping hazards, compacts the surfacing, and provides a breeding ground for insects. Playgrounds should have open lines of sight for security and supervision, with some shaded areas for sun and weather protection. In windy areas the use of protective windbreaks, walls and trees should be incorporated. This will not only improve the environment for play, but will also help keep the protective surfacing materials from blowing away. Fences are generally required for traffic safety, campus boundary identification and security reasons.

Surfacing - Protective surfacing material must be matched to the height of the play equipment. Surfaces may include sand, pea gravel, wood and bark chips, ground rubber (not tires!), and manufactured mats or unimat systems. Each has a different protective quality for certain heights of equipment. For instance, nine inches of uncompressed wood chips will provide minimum fall protection for falls from ten feet or less, while the same depth of uncompressed fine sand will only protect for falls up to four feet. The critical fall height for a child's head to asphalt is two inches and for concrete the critical fall height is one inch. The G-forces exerted on a child’s head is 210 times the force of gravity from these minimal heights. In order to meet CPSC guidelines, surfaces must not exceed 200 G’s or “G-max.” The threshold for a serious head injury is 50 G-max and for a fatality, 200 G-max. A product that some see as a magic bullet, rubber matting that is one and three-quarters inch thick, will not protect from a fall from a five-foot height.

Loose surfacing material will not stay in place unless it is contained. Beams and/or berms are often used to do this above existing grade, while placing the material below existing grade eliminates the need for containment devices by excavating the equipment fall zones and filling them with a resilient material. If containment devices are used, they must be adequate to hold the proper depth of material. Using a 6-inch timber will only contain 6 inches of material. This is usually insufficient protection for falls on most equipment. The containment structure acts as a visual measure of surfacing depth and minimizes spillover to hard or grassy play surfaces.

The selection of surfacing materials should not be based solely on the "up-front" costs. Maintenance and replacement costs as well as fall protection values must also be considered. In addition, surfaces and containment structures now must allow for use by persons with disabilities. A handy reference for falls protection surfaces is contained in the 1991 Consumer Product Safety Commission handbook 1991.

There are several other design issues that must be considered in order to protect children. Fall zones, use zones and travel pathways need to be identified in the early design stages in conjunction with equipment solar heat gain (the "hot slide syndrome"). Toxic materials and

poisonous plants must also be designed out of the playground. These and other factors should be addressed prior to equipment installation. The next major safety concern is the equipment itself.

Sizing the Equipment to the Children's Needs

Local parent groups are often the ones who buy the play equipment. Parents need to be knowledgeable about the relationship of the equipment to the children and consider their various ages, play patterns, and developmental differences. These issues should control the equipment purchases since they embrace the concept of "age-appropriateness", which is the key factor in the safety and purpose of children's play. There are two factors involved here. First is the size of the children, and second is their play stages, or patterns.

Children move through predictable patterns of play. Generally they go from playing alone to playing with others. In addition, they go from using something (e.g. a ball) as the primary object of play to using something as a means to interact with other children socially. Very small children play with objects and then progress to equipment that is larger and more complex. Older children move gradually away from objects and equipment to games involving skill and peer interaction.

In an elementary school there is a wide range of sizes in children, ranging from kindergarten through fifth or sixth grade. Within a given age group however, there is a narrower range of sizes. The same can be said of the differences in physical strength and ability among children of the same age group. These are critical considerations when making any equipment purchase. Parents should ask, "Who is the equipment for and what are their particular play interests, abilities and needs?" One play structure or climber will not fit all children and, significantly, may pose a safety hazard to many other children. For example, a horizontal ladder that is seven feet tall accommodates only sixth graders and is inappropriate to third graders and below, who are the very ones who will want to use it.

Appropriate structures for younger school children in kindergarten through third grade would include modular units with several play events. These structures should be colorful, interesting, and challenging. Overhead devices, such as ladders, should be sized to the third graders and be approximately 60-70 inches from the protective surface. School districts should be encouraged to provide separate kindergarten structures and a larger, more integrated structure for first through third graders.

Socialization, peer interaction and games with rules start at about age 8 or 9. Thus, third-graders have an increased need for hard court and game areas. Four-square, two-square and basketball, for example, move up in importance. When these children do move over to the play structures it is often more for social gatherings, games of tag and "king of the mountain", or just to sit and observe. In addition, certain pieces of equipment become objects of challenge for what is called the "dare

curriculum." ("I bet ya can't....."). The critical height of this equipment must be considered in conjunction with the surfacing selections. Taken together they lead to logical safety and maintenance recommendations.

Single use or “freestanding” play events are acceptable and traditional play events, however the major focus of modern playground designs is on play structures, or modular units, rather than on individual free-standing units. This is not to say the department of health is trying to push structures at parents, because this can easily be overdone. Rather it is because of the high “play mastery rate” of children playing on this type of equipment. Children get bored easily, and once a child has a piece of equipment mastered they will "create" other uses. Not all of these uses are safe or desirable. While this "freestyling" takes place on modular structures too, their inherent complexity increases appropriate play time while the deck and equipment design enhances safety by way of providing multiple "way out" or escape choices for the child. From a usage and safety point of view then, appropriately selected, multi-activity structures are a better value than most free-standing single events. Parenthetically, the majority of injury information collected by the Consumer Product Safety Commission has come from playgrounds with a high volume of single-use play events. One caveat about multi-deck equipment, however: do not place play events so close together that children will be tempted to jump (or accidentally fall) from one onto another. There are no ASTM or CPSC standards or guidelines on minimum spacing at this time, however it is anticipated that this will be addressed in the future. As a rule of thumb, do not put two events on the same side of a 4x4 platform if it is possible to fall or jump from one event to the other.

What Parent-Teacher Groups Should Do

Contact Local Health Agency

Since 1992 many local health departments throughout Washington State have either been trained or have access to resources through the Department of Health on playground hazard identification and strategies to mitigate hazards. Assessments of existing school are an integral part of many local health departments. Assistance with designing new playgrounds or additions to existing playgrounds may also be available, depending on local health agency capabilities. These agency resources, although not uniformly available, should be consulted by parents and others prior to making significant decisions regarding school playgrounds, since they are part of the school facilities for which the local health agency has safety responsibility under State Board of Health Rules (WAC 246-366).

Become Familiar With CPSC and ASTM

Remember - not all play structures are created equal. Your group should inquire about and insist on obtaining written assurance that the

equipment you are buying meets the recommendations of the *1991 Consumer Product Safety Commission (CPSC) Handbook on Public Playground Safety. The CPSC Handbook references the American Society for Testing and Materials (ASTM) specifications for playground equipment for public use. These ASTM specifications, known as ASTM F 1487 - 95 establish nationally recognized safety standards for public playground equipment and is intended to minimize the likelihood of life-threatening or debilitating injuries, such as those which have been identified by the CPSC. Equipment which does not conform to CPSC and ASTM may jeopardize children and create a potential problem in Washington State since CPSC and ASTM are used by state and local health departments as the basis for safety recommendations to school districts. Furthermore, case law has established CPSC and ASTM as the yardstick for determining whether equipment was or was not partially at fault in injury cases. Washington State has used CPSC since 1981, when the first version of its handbook was published.

* *A revised version of the handbook was published in October, 1997 and should be accessed and used for future school playground designs. It can be downloaded and printed from the Worldwide Web on the Internet, since it is entirely in the public domain. The CPSC address is : http://www. cpsc. gov*

School Risk Managers and Insurers

In addition, most insurance companies and Educational Service Districts have safety specialists who provide assistance to schools as part of the insurance policy. Finally, many school districts have their own safety officers who can help with equipment selection. These resources, in varying degrees, are available to parent groups, and PTA's are encouraged to seek them before undertaking a playground project. By using an integrated, well thought-out plan, future injuries, disabilities and liabilities can be reduced.

Annotated Bibliography on School Injuries

GENERAL TOPICS

American Academy of Pediatrics Policy Statements.
A listing of policy statements relevant to school injury has been compiled by Children's Safety Network.

Evans, GD, & Sheps, SB. (1987). *The epidemiology of school injuries: The problem of measuring injury severity.* Journal of Community Health, 12(4): 246 - 256.
Examines the association between two commonly used measures of injury severity and referral to medical assessment. Reviewed 3,000 school accident reports in Vancouver. Concludes that the major issue facing school staff is appropriate referral of the child for medical treatment.

National School Safety Center. *School safety*.
This publication regularly covers topics of bullying, violence in schools, and other safety concerns. Published by the National School Safety Center, 4165 Thousand Oaks Blvd., Suite 290, Westlake Village, CA 91362. Phone: (805) 373-9977.

Office of Technology Assessment. (1994). *Risks to students in schools*.
This background paper reviews the available data on environmental hazards, infectious diseases, and unintentional and intentional injuries occurring in schools K-12. Available for $14.00 from the Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7974. Phone: (202) 783-3238. Stock number 052-003-01447-5.

Wilson, MH, Baker, SP, Teret, SP, Shock, S, & Garbarino, J. (1991). *Saving children: A guide to injury prevention*. NY: Oxford University Press.
This book is aimed at educators, policy makers, and health care providers. Each chapter contains a section on opportunities for prevention, organized by audience, and including schools. Part IV focuses on the school and recreation environment: playground injuries, sports injuries, and drowning and other water-related injuries.

Boyce, TW, Sprunger, LW, Sobolewski, S, & Schaefer, C. (1984). “Epidemiology of injuries in a large, urban school district.” Pediatrics, 74(3): 342 -349.
Describes the results of 5,379 school injury reports over a two-year

period. Eighteen percent of the injuries were severe; playground- and equipment-related injuries were more likely to be severe; and there were 49 injuries per 1,000 student years.

Boyce, WT, & Sobolewski, S. (1989). Recurrent injuries in schoolchildren. American Journal of Diseases of Children, 143: 338 - 342.

Identifies injuries over three school years from school nurse reporting forms. One percent of the school district population sustained recurrent injuries, especially among boys, junior high students, and students in alternative educational programs.

Bremberg, S. (1989). “Is school-based reporting of injuries at school reliable? A literature review and an empirical study.” Accident Analysis and Prevention, 21(2): 183 - 189.

Combines a literature review of studies from six countries with a four-year empirical study in Sweden of injuries requiring physician treatment. Results indicated that routine school nurse reports underestimate the extent of injuries.

Dale, M, Smith, ME, Weil, JW, & Parrish, HM. (1969). “Are schools safe? Analysis of 409 student accidents in elementary schools.” Clinical Pediatrics, 8(5): 294 - 296.

Examines accidents as recorded on school report forms (including those that did not always result in injury), and concludes that boys and second graders experienced the most accidents, most events occurred during lunch hour and recess, and head injuries accounted for 64 percent of the injuries.

Feldman, W, Woodward, CA, Hodgson, C, Harsanyi, Z, Milner, R, & Feldman, E. (1983). “Prospective study of school injuries: Incidence, types, related factors, and initial management.” Canadian Medical Association Journal, 129: 1279 - 1283.

A prospective study of school accident report forms from 212 schools over one year revealed that most injuries occurred during athletic activities and 28.7 percent of all injuries were serious.

Fothergill, NJ, & Hashemi, K. (1991). “Two hundred school injuries presenting to an accident and emergency department.” Child: Care, Health and Development, 17(5): 313 - 317.

Analyzes 204 medical exam records of students injured at school and brought to an emergency department in Surrey, England. Over half of the injuries occurred while students were unsupervised.

Hodgson, S, Woodward, CA, & Feldman, W. (1984, May/June). “A descriptive study of school injuries in a Canadian region.” Pediatric Nursing, 215 -220.

Analyzed over 4,000 school accident report forms as well as parent recall and school board records. The results showed an occurrence of 5.4 injuries per 100 children with 29 percent of the injuries deemed

serious. Discusses the importance of the school nurse's role in addressing these issues.

Hodgson, C, Yacura, W, Woodward, C, Feldman, W, & Feldman, E. (1984). “Sequellae of school-related injuries: School and parent perspectives.” Canadian Journal of Public Health, 75: 273 - 276.
A prospective study of three boards of education over one year found that schools underestimated the number of health care visits resulting from school injuries, and parents overestimated the amount of first aid provided at school.

Hodgson, S, Woodward, CA, & Feldman, W. (1985). “Parent report of school-related injuries.” Canadian Journal of Public Health, 76: 56 - 58.
Fifteen percent of respondents in a random survey of parents reported that their children had been injured at school during the previous month.

Langley, JD, Silva, PD, & Williams, SM. (1981). “Primary school accidents.” New Zealand Medical Journal, 94: 336 - 339.
Analyzes two years of standard school accident report forms. Of 518 primary school injuries, nearly one-third resulted in fractures.

Langley, JD, Chalmers, D, & Collins, D. (1990). “Unintentional injuries to students at school.” Journal of Pediatric Child Health, 26: 323 - 328.
Examines national mortality data and over 1,000 hospital admissions in New Zealand. Deaths from school-related injuries were most frequently the result of falls. Overall incidence rate for hospitalization from school injury was 151 per 100,000 students per year.

Lenaway, DD, Ambler, AG, & Beaudoin, DE. (1992). “The epidemiology of school-related injuries: New perspectives.” American Journal of Preventive Medicine, 8(3): 193 - 198.
Prospective surveillance of a modified student injury report form from nine Colorado schools over one school year showed that sports activities accounted for 53 percent of all injuries; middle/junior high school had the highest rates.

Nader, PR, & Brink, SG. (1981). “Does visiting the school health room teach appropriate or inappropriate use of health services?” American Journal of Public Health, 71(4): 416 - 419.
A study of over two school years of a random sample of urban K-5 children concluded that trauma was the most frequent reason for a visit to the school health room, across all ages, gender, and socioeconomic groups.

Passmore, D, Gallagher, S, & Guyer, B. (1989). “Injuries at school: Epidemiology and prevention.” Harvard Injury Control Center Working Paper Series, No. 17. Boston: Harvard University School of Public Health.
A population-based study of injuries requiring hospital treatment or resulting in deaths found that injuries at school account for 9.5 percent of

all injuries. Of these, 36 percent involve a product (usually a stair, wall, bleachers, or recreation or sport equipment).

Sheps, SB, & Evans, GD. (1987). “Epidemiology of school injuries: A two-year experience in a municipal health department.” Pediatrics, 79(1): 69 - 75.
A retrospective Canadian study of injury report forms for two school years showed a rate of 2.82 injuries per 100 students per year; contusions and abrasions to the head were the most frequent type of injury. Falls were most common among elementary school children; sports injuries were most frequent among secondary school students.

Taketa, S. (1984). “Student accidents in Hawaii's public schools.” Journal of School Health, 54(5): 208 - 209.
One school year of student injury report forms from 204 schools showed the highest number of injuries occurring in the intermediate grade level, and 43 percent of injuries involving the head and neck .

Woodward, CA, Feldman, W, Feldman, E, Hodgson, C, & Milner, R. (1983). “The McMaster school injury student 1: Overview of methods. Canadian Journal of Public Health, 74: 276 - 280.
Describes the research design, sampling strategies, and analysis procedures used in surveying school injuries in Ontario.

PLAYGROUNDS AND SPORTS INJURIES

“American Orthopedic Society for Sports Medicine. (1988). Sports injury research.” American Journal of Sports Medicine, 16(Supp. 1).
Research issues and findings in sports medicine as well as vignettes, information on four surveillance systems, and a primer for beginning sports injury researchers.

Arizona Department of Health Services, Community and Family Health Services, Office of Women's and Children's Health. (1993).
A study of the nature, incidence and consequences of elementary school playground-related injuries: Final report. Tucson, AZ: Arizona Department of Health Services. Summarizes the results of the first year of using injury report forms in grades K-8 to collect data on body part injured, actions taken by schools and parents, type of surface and equipment involved, and activity in which student was engaged. Samples of injury form, data base descriptions and data forms are included.

Association of Trial Lawyers of America, Johns Hopkins Injury Prevention Center. (1992). *Good sports: Preventing recreational injuries*. Washington, DC 20007.
Summary of a safety conference that included presentations, discussion, and recommendations on school sports injuries and playground injuries.

Consumer Product Safety Commission. (1994). *Handbook for public playground safety*. Washington, DC 20207.
Covers major types of equipment, surfacing, use zones, layout and design.

Daugs, DR & Fukui, F. (1989). *Playground perspectives: A curriculum guide for promoting playground safety*. Salt Lake City, UT: Utah Department of Health.
Provides background information, classroom activities and resources for teachers with an emphasis on grades K-3.

Helsing, K. Massachusetts Sports Injury Prevention Task Force. (1990). *The status of sports injury prevention and treatment among Massachusetts high school interscholastic athletic programs*. Boston, MA 02111.
Assesses the status of injury prevention within high school athletic programs in Massachusetts and identifies 15 areas of concern. Provides specific recommendations to address these concerns.

National Institute of Arthritis and Musculoskeletal and Skin Diseases, U.S. Department of Health and Human Services. (1992). *Conference on sports injuries in youth: Surveillance Strategies. Proceedings and executive summary*. Bethesda, MD 20892.
Provides recommendations and findings from a 1991 conference including the need for a uniform surveillance system, national database of sports-related injuries, investigation of re-injury rates, and evaluation of standard classification systems.

National Youth Sports Foundation for the Prevention of Athletic Injuries. (1994). *Bibliography of youth and adolescent sport medicine literature, June 1990 - 1994*. Needham, MA 02192.
Includes a list of sports medicine books currently in print and journal articles on the subject. Supplements an earlier bibliography, covering 1984 to June 1990.

Sosin, DM, Keller, P, Sacks, JJ, Kresnow, M, & van Dyck, PC. (1993). "Surface-specific fall injury rates on Utah school playgrounds." American Journal of Public Health, 83(5): 733 - 735.
Studies injury reports from elementary schools over two years to estimate fall injury rates and the surfaces involved. Data showed that impact-absorbing surfaces do not reduce fall injuries better than grass. However, surfacing on site did not meet CPSC guidelines for falls protection, therefore conclusions are misleading.

Thompson,T. and Ellis, R. (1992) *School Playground Safety;* The Child Advocate, Washington State PTA.
Causation of injury and playground design recommendations are described.

PREVENTION, INTERVENTION AND LIABILITY

Child Accident Prevention Foundation of Australia. (1993). *School safe: A program for injury prevention in primary schools.*
Covers the components and process of an effective school safe program, common school accidents, helpful hints, and curriculum starters organized by elementary-, middle-, and upper-school levels. Available from Kidsafe Australia, 10th floor, 123 Queen Street, Melbourne, Australia 3000. Fax: (61) (3) 670-7616. Cost is $20 Australian.

Gerlovich, JA, & Gerard, TF. (1989). *Don't let your hands-on science program blow up in your face*. American School Board Journal, 176(5): 40 - 41.
Advice for administrators and school board members on their responsibilities and on the wisdom of conducting safety audits.

McKenzie, JF, & Williams, IC. (1982). “Are your students learning in a safe environment?” Journal of School Health, 52(5): 284 - 285.
Presents no data but acknowledges that unsafe conditions exist in schools and that teachers must be responsible for providing a safe environment. A teacher checklist for self-awareness of safety is included.

Padham, EA. (1990). “Safety: Your first responsibility.” Vocational Education Journal, 65(2): 16 - 17.
Advocates for a school safety philosophy with clear policies for teachers, administrators, maintenance staff, students, and shop architects.

Sabo, SR. (1993, January). “Security by design.” American School Board Journal, 37 - 39.
Discusses safety issues that can be addressed by architects so that the building design enhances security, on both the exterior and interior of the facility.

Texas Education Agency, Office of Curriculum, Assessment and Professional Development. (1994), *Safe school checklist*. Austin, TX: Texas Education Agency.
Helps students, parents, teachers, and administrators assess a school's safety strengths and weaknesses. Topics include accidents, assaults, violent behavior, natural disasters, and suicide attempts. Checklists are included and the document is issued in English and in Spanish.

SAFETY FOR STUDENTS WITH SPECIAL NEEDS

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Based on a survey of special educators and parents of children with special needs, this article presents a list of safety concerns across different age groups.

SCHOOL BUS SAFETY

Harrington-Lueker, D. (1992). “School buses buckle up.” American School Board Journal, 178(11): 37 - 38.
New Jersey became the first state to require the use of seat belts on school buses; arguments for and against this requirement are summarized.

National Highway Traffic Safety Administration. (1992). *Traffic Safety Facts 1992: School Buses*. Washington, DC: NHTSA.
Four-page summary provides tables of occupant fatalities by principal impact point on school bus; school-age pedestrians killed by school bus vehicle maneuver; fatalities by time of day; and other information on fatalities associated with school buses for 1983 to 1992.

National Highway Traffic Safety Administration. (1993, May). *School Bus Safety Report*. Washington, DC: NHTSA.
Summarizes and updates school bus safety activities conducted by NHTSA and points out that school bus crashes tend to be minor, while pedestrians--particularly five and six year olds--are significantly at risk around school buses. Seat belt issues and using vans as school buses are also addressed.

Spital, M, Spital, A, & Spital, R. (1986). “The compelling case for seat belts on school buses.” Pediatrics, 78(5): 928 - 932.
Argues that training children to use seat belts on school buses will keep them safer and will instill lifelong habits of seatbelt use.

LEGAL AND LIABILITY ISSUES

American Trial Lawyers Association. *ATLA Law Reporter*. Washington, DC: ATLA.
Gives examples of unusual and noteworthy awards resulting from injuries in the school environment; issues monthly.

Dunklee, DR. (1989, July). “An educator's responsibility for proper maintenance of property.” School Business Affairs, 25 - 27.
Briefly discusses school liability for personal injury that results from negligent maintenance.

Grier, TB, Reep, BB, & Turner, MJ. (1991). “Follow these 10 cardinal rules and stay out of court.” The Executive Educator, 13(8): 21 - 22.
Advice for principals, including steps to ensure student supervision, reporting of dangerous situations, and preparing emergency procedures.

Vos, R, & Pell, SW. (1990). “Limiting lab liability: Protect yourself and your students.” The Science Teacher,57(9): 34 - 38.
By examining several litigation cases, the authors demonstrate that teachers are held responsible for vigilantly supervising their lab students. Self-assessment checklists for teachers, guidelines to mitigate the risk of liability, and a list of proper safety actions are included.

VIOLENCE ISSUES

Metropolitan Life Insurance. (1993). The Metropolitan Life survey of the American teacher, 1993: *Violence in America's public schools*. New York, NY: Metropolitan Life Insurance Company.
A national survey found that despite media attention to crime and violence in schools the large majority of teachers and students feel safe and have not been personally involved in a violent incident. Students do see and fear violence more than teachers do; law enforcement officials express the highest levels of concern about violence in public schools.

National School Safety Center. (1990). *School safety check book*. Malibu, CA: Pepperdine University. Covers school climate and discipline, attendance, personal safety, and school security. Prevention and response strategies and assessment surveys for each of these topics are included.

CHILDREN'S SAFETY NETWORK

The Children’s Safety Network seeks contributions to its expanding collection of materials relating to school injuries. They are interested in literature from the fields of injury prevention, education, litigation, public health, etc. If you have suggestions of additional articles, studies, reports, or other materials, please write them at: Resource Librarian, Children's Safety Network, EDC, 55 Chapel Street, Newton, MA 02158-1060 or FAX to (617) 244-3436. Their e-mail address is, csn@edc.org. Phone is (617) 969-7100

WASHINGTON STATE DEPARTMENT OF HEALTH SCHOOL PROGRAM

The Washington State Department of Health Office of Community Environmental Health administers state board of health rules which promote student health and safety. If you have information regarding school children’s health and safety, they would be interested in hearing from you. Write to the Washington State Department of Health, School Program Coordinator, P.O. Box 47826, Olympia, WA 98504-7826, or call (360) 236-3072. E-mail to: ree0303@doh.wa.gov.

Section Three

ELEMENTARY SCHOOL INJURY SURVEILLANCE

SECTION EXECUTIVE SUMMARY

Introduction

Injuries are the leading cause of death and disability for children of school-age in the United States with approximately 22 million occurring every year. It is estimated that nearly one-fourth of these occur in or near the school environment, yet, there is little known about the epidemiology of school-based injury.

From October 1993 through June 1996 a pilot elementary school injury surveillance system was implemented in Washington State. The goal of the project was to develop a systematic approach to assessing the magnitude and characteristics of the injury problem in elementary schools. This information could be used to develop injury risk prevention and intervention strategies that could reduce the incidence of injury at school.

The main objectives of the pilot system were (1) to determine the feasibility of monitoring injury on-site at school using existing school staff; (2) to increase the understanding of the epidemiology of school-based injury; (3) to develop injury prevention and intervention strategies. The pilot system consisted of 15 elementary schools from 5 school districts located in 4 Washington state counties comprising a total enrollment of about 6450 students. Participation was voluntary; the sample was not randomly selected. Therefore findings cannot be directly generalized to all elementary schools in the state.

Injuries that required any treatment and that occurred during the school day at school were by protocol reported to the system. This was done by completing a standard injury reporting form which provided the following information:

- personal characteristics of the injured student such as gender, grade, etc.
- circumstances and mechanism of injury
- outcome of the injury event such as body part injured, treatment, etc.

School personnel, usually a school secretary or playground aide, were responsible for injury reporting. There was not a full-time nurse at any of the schools but when needed there was one with whom consultation about medical decisions took place. Playground and playfield injuries were emphasized in the analyses of the data and the discussion and interpretation of the results.

Summary of Results

The results of an evaluation of the pilot injury surveillance system provided information from which limitations on the interpretation of the injury data analysis results were identified. They also suggested modifications that could help to address some of the issues that affected injury reporting at most of the participating schools. Some of the system characteristics that were identified through this evaluation included the following: evidence of underreporting and case ascertainment bias; inconsistent integration of the project protocol with the existing injury recording procedures at many of the schools; inconsistent interpretation of the broad case definition; and other issues, including data flow problems, that affected the overall usefulness of the information for the project participants. A complete surveillance evaluation report has been prepared for DOH as a separate document.[1]

There were three main categories of analyses presented for the collected injury data. These included:

- a summary of the overall results
- an emphasis on playground and playfield injuries
- focus on the results obtained from the six schools that had the most consistent reporting

Overall results

Overall results follow (injury rates are presented as '*number of injuries/100 student-years'*; 95%CI=95% confidence interval):

- **Number of reported injuries included in analyses** 2730 (98% of the total number of injury forms received; 2% excluded for lack of required information)
- **Weighted average crude injury rates** The rate combined over three years of data collection was 17.6 (95%CI=16.9-18.3) and there was considerable variation in this rate over time:

  1993-94 25.2 (95%CI=23.6-26.8)

  1994-95 10.9 (95%CI=10.1-11.8)

  1995-96 19.6 (95%CI=18.5-20.8)

- **Grade and gender:** Injury rates estimated for boys and girls were about equal through 3rd grade. In the upper grades the boys had about a 40% greater injury rate than the girls.

- **Location of injury event:** 67% of the reported injury incidents occurred on the playground or playfield; 15% took place at 'other' outdoor locations; 17% happened in the gym or other indoor locations.
- **Time of day:** Nearly 50% of playground and playfield injuries occurred between 11 AM and 1 PM, the time at many schools when lunch and lunch recess took place for 1st through 5th graders.

Playground and playfield injuries

The more important findings for the playground/playfield injuries follow:

- **Playground equipment:** Preliminary information was provided from playground equipment assessments that had been done by the Washington State Department of Health (DOH) at the 15 participating schools. This information is not yet available for analysis. From a preliminary descriptive summary of the total number of pieces of each type of play equipment at the participating schools the relative numbers of pieces of the various types of play equipment were determined. There were 254 pieces of equipment at the 15 participating schools with over 90% in the following equipment type categories (presented in the order of decreasing total numbers of pieces at all of the schools combined): spinners; climbers (excluding spinners and dome climbers); the overhead apparatus; structures; tire swings and dome climbers.
- **Equipment involvement:** 40% of playground injuries were associated with play equipment. Most reported injuries were associated, in decreasing order of frequency, with the following types of play equipment: structures; the overhead apparatus; tire swings; spinners; climbers (excluding spinners and dome climbers); and dome climbers.
- **Grade-level and play equipment:** The older children reported play equipment related injuries less frequently than the younger children.
- **Falling:** About half of the playground/playfield injuries involved falling and, though the majority of these were falls at ground level, there were about 40% that reported falling from elevated heights. In the absence of play equipment involvement, about 1/3 of the reported falls occurred onto a hard surface such as blacktop or concrete. Among the playground/ playfield injuries falling was associated with more intensive treatment with about twice the frequency of injury incidents that did not report falling.
- **Play equipment and falling:** Falls were reported more often for injuries involving play equipment(60%) than for those that did not involve equipment(47%). Less than 5% of equipment related injury incidents with falling occurred onto a hard surface.

Equipment related injuries reported falls from an elevated height nearly 20 times as often as those not equipment related.

- **Falling from specific types of equipment:** The structure, climbers, overhead apparatus and tire swings were the types of equipment identified for more than 80% of the equipment related injury incidents. Overall, of the 363 injuries reporting falling and involvement of these four types of equipment there were 310(85%) that fell from an elevated height. Seventy-eight percent of the 102 injuries involving the structure, 99% of the 75 overhead apparatus injuries, 90% of the 142 involving climbers and 64% of the 44 injuries associated with tire swings reported falling from an elevated height. Spinners and dome climbers accounted for about 60% of the climber related injury incidents. Fifty-two(96%) of the 54 spinner related incidents and 88% of the dome climber related incidents reported falling from elevated heights.
- **Play equipment and injury characteristics:** About 13%(n=94) of the 738 equipment involved injuries were more intensively treated off-site at a clinic or hospital. Half of the 738 equipment related injury incidents reported head and neck involvement while another 40% reported that the upper and lower extremities were affected. Of the 94 more intensively treated equipment involved injury incidents, about 30% (n=28) reported a dislocation or broken bone affecting an injured student's arm, wrist or hand.
- **Falling from play equipment and injury characteristics:** Nearly 20% of the 363 injury incidents that reported falling associated with the structure, climbers, tire swings or the overhead apparatus also reported more intensive treatment off-site at a clinic or hospital. Twenty-eight percent of the 74 overhead apparatus related injuries that reported falling from an elevated height were among those more intensively treated.
- **Playing or fighting with other children:** Nearly 40% of the1837 playground/playfield injury reports indicated fighting or playing with other children as a circumstance of the incident: about 70% of these interactions were described as 'playing' while only about 15% reported 'fighting or misbehaving'. Among incidents reporting neither equipment nor fall involvement the percentage that reported involvement with another child increased to about 75%.

Schools reporting more consistently

Six of the 15 participating schools were found to have reported injuries to the system more regularly than the other 9 schools. The number of injuries reported to the system by these schools accounted for more than 80% of the total number of injury reports included for data analyses. Some limited analyses were done only on these six schools. A summary

of these results follows (injury rates are given as '*number of injuries per 100 student-years'*; 95%CI=95% confidence interval)

- **Weighted average crude injury rates by year** Though there was a decline in this summary estimate rate during year 2, three of the six schools showed no decline in the year 2 school-specific injury rates. The year 1 and year 3 combined estimate from these six schools is the same. The injury rates were more stable over time than for the other nine participating schools:

  1993-94 40.9 (95%CI=37.9-44.0)

  1994-95 21.4 (95%CI=19.6-23.3)

  1995-96 40.3 (95%CI=37.5-42.8)

- **Play equipment and falling:** Fifty-eight percent of the 625 play equipment involved injuries reported falling and about 80% of these falls occurred from an elevated height. About 85% of the 295 equipment related injury incidents that involved falling from an elevated height reported the involvement of the following specific types of equipment: structure (22%); climbers not including spinners (19%); spinners (15%); tire swing (9%); overhead apparatus (20%). Twelve percent of these 295 injury incidents were treated more intensively at a clinic or hospital.

Outdoor locations other than the playground or playfield

- **Falling:** Of the 398 injuries reported to have taken place at outdoor locations other than the playground or playfield, about 60% involved falling with more than 90% of these occurring at ground level. In contrast to the playground/playfield injuries involving falls, nearly 80% of those at 'other outdoor locations' were reported to have occurred onto a hard surface such as concrete or blacktop and 28 (15%) of these injuries were evidently perceived as severe enough to have been treated more intensively at a clinic or hospital.

Intervention study

The results of the study that was designed to assess the impact of supervision and physical site changes on injury incidence at the participating schools, using a quasi-experimental design, were not interpretable. There were design and implementation issues that affected this study. A more complete evaluation of this study can be found in two separate reports to DOH which are cited in the reference section of this report.

Conclusions and Recommendations

The results from the analyses of the collected injury data and the evaluation of the pilot surveillance system provided unique information

about school injury. There were, however, important limitations to the interpretation of the results of this project. Those that probably had the greatest impact on these results were:

- evident underreporting and case ascertainment bias that was apparent in the data collected from most of the schools
- some confusion over the scope of the injury reporting protocol (i.e. whether it included only playground injuries or all injuries)
- the use of a case definition that was very broad, lacked specificity, and was difficult to use in a consistent way by different project personnel at the participating schools
- information flow problems that resulted in an absence of feedback to the schools in a timely manner
- no available database for assessment of possible injury risk factors in the school setting (i.e. play equipment characteristics; playground characteristics; etc.)

Keeping these limitations in mind, the results from the project, especially those derived from playground and playfield injury data, still gave some useful and unique information about who is injured, when these injuries occurred and, to some extent, how they occurred. They also pointed out some important gaps in information. Differences between the schools, for example, in the percentage of equipment involved injuries, suggested the need for information to more accurately assess predictors of injury in the school setting. Also, reliable direct measures of injury severity were not obtained from the study as it was implemented. The reported treatment was used as an indirect indicator of injury severity. The association between treatment and reported injury characteristics cannot be easily interpreted. This observation does generate questions that could be investigated further and that might have implications for the development of school safety strategies.

Providing information to schools for the systematic development of school safety strategies would be a primary goal of a school injury surveillance system. This pilot provided a framework for doing this. The limitations mentioned above, however, suggest some important modifications that need to be made in order for the system to be more easily integrated into a school's normal operation and thus, to enhance the likelihood of better data quality.

Even with such modifications, however, the identification of injury risk factors at schools together with some estimation of risk magnitude would be important to developing rational school injury prevention and control strategies. It would be important to have this information if there were concerns about the needs for modification of school environment factors such as the playground equipment, the play activity curriculum, playground supervision protocols and others. In this project, where assessment of playground equipment involvement in school injuries was emphasized, data for playground injury risk factor assessment was not available for analysis. Some descriptive information, however, not

available for presentation in this report, showed much variation between schools in the structure of the play environment, the play curriculum, and the actual number and types of pieces of play equipment. Any further research in this area would benefit from inclusion of the study of these types of factors to learn more about how they are related to injury incidence in the school setting.

From the results of this project the following recommendation are suggested:

- **General** The partnerships developed in the implementation of the project are very important to the continued enhancement of building capacity at the state level to address issues of public health and safety in the schools. These should be recognized and continued efforts made to find ways to build on this starting effort. In particular, any future school-based injury surveillance projects should be developed with more involvement of parents, school staff, and LHJ personnel.
- **Injury surveillance in schools** The operation of this system, as well as the type of data that were collected, suggest that surveillance could be useful in identifying and targeting groups of students or particular types of school-based circumstances that might be associated with injury and amenable to intervention strategies for its prevention or reduction. However, the results of the project do not suggest that the next step should be advocacy for a statewide school-based injury surveillance system. There are important modifications that need to be made to the system to make it more acceptable at the school level; simpler reporting mechanisms are needed with strong central coordination. In addition, the uses of the data and the priority of this assessment activity for both schools and the state need to be considered before recommending further surveillance activities.
- **Dissemination of information** The results of the project, interpreted appropriately and cautiously, need to be shared in an accessible way with a wide range of constituencies, especially the schools, parents, district personnel of the participating schools, as well as LHJ staff and others in the state. An important outcome can be the building of local capacity to develop more rational strategies for injury prevention.

BACKGROUND

There is little available information in the literature on the epidemiology of elementary school-based injury. It has been estimated that approximately 22 million injuries occur among children more than one year old, in the United States every year. Ten to twenty percent of these occur in school or on the way to or from schools. Among elementary school students in a Washington state school district, one study reported

74% of injuries occurring on the playground. About 25-40% of playground injuries have been reported associated with play equipment.[2, 6, 12] Though this suggests that a large number of children's injuries are associated with hazards in the school environment, the identification of these hazards and more accurate assessment of the risk associated with them has yet to be determined.

The fact that children older than five years spend a large portion of their time in the school environment further emphasizes the importance of assessing the magnitude of the school injury problem. Acquisition of more complete school injury incidence estimates and information describing the mechanisms and circumstances of injury incidents can help lead to a better understanding of the risk of injury associated with hazards in the school environment. This is the type of information that is essential to the development of potential intervention and prevention strategies for reducing the number of injuries in the school environment.

There are some unique methodological problems inherent in doing studies of the epidemiology of injury.[5] These include the following:

- Enumeration of the 'exposed' or 'at-risk' population (denominator for rate estimation)
- Accurate injury ascertainment(numerator for rate estimation)
- Role of multiple injuries per person over time of study in assessment of injury incidence
- Appropriate presentation of results for injury incidents with multiple body parts injured

Consideration of these issues is important in designing injury epidemiology studies , as well as in analyzing the data collected. Often, available injury data is limited and these issues cannot be fully explored. For example, most studies of childhood injury have focused on more severe injuries. These injuries have typically been identified and described directly from hospital discharge and emergency room discharge summaries, or indirectly from the trauma registries derived, at least in part, from them. The hospital discharge data does not, however, systematically identify those severe injuries that occur in school settings. From the literature, the few studies that have attempted to estimate injury rates among elementary school-age children generally have referred to those injuries that are more severe and that have required hospitalization or emergency room treatment. While providing some interesting information about childhood injury, this type of data is not specific enough to provide valid interpretations that are useful to schools in their development of safety planning strategies.

Estimation of the magnitude of the injury problem in the elementary school setting, and the identification of risks associated with school-based injury, call for the systematic collection of information describing those injuries occurring at school. Public health surveillance appears to be an appropriate method for doing this. It is used to monitor the incidence of many health events and has been used in a few settings to

try to assess the magnitude of the school-based injury problem in some areas.[4, 7] The available evidence suggests that the proportional distribution of injury characteristics and circumstances varies quite considerably between grade levels at schools and between genders. However, a better understanding of the characteristics of elementary school injuries and, in particular, of those that occur on the playground and that involve playground equipment, is needed.

Seven important characteristics of surveillance systems have been described.[3, 8] These are as follows:

- simplicity
- acceptability
- flexibility
- sensitivity
- predictive value positive
- representativeness
- timeliness

Evaluation of these characteristics provides a tool to assess the effectiveness of a given surveillance system in meeting its objectives. An elementary school injury surveillance system needs to be acceptable to those responsible for its implementation. It also must be sensitive enough to identify injuries in the school environment according to the case definition. The degree to which it accommodates changes (e.g. in the school environment; in the community) that might affect the system's protocol, or the pattern of injury, reflect its flexibility. The use of the injury information collected from an elementary school surveillance system depends on how representative this is of injuries occurring in the schools and also, how representative the monitored population is relative to the source population from which it came. Finally, timely feedback of school injury information to the public health and education communities, as well as to other 'stakeholders', increases its potential usefulness for the development of school safety strategies.

To learn more about assessment of injury in the school setting and, thus, provide some guidance for school safety discussions and planning, a pilot elementary school injury surveillance system comprising 15 elementary schools was implemented in Washington state from 1993-1996. This section of the report includes a description of this project as well as the results and interpretation of the analyses of the injury data collected. Both the assessment of how well the piloted system operated and what was learned about school injury are discussed.

METHODS

Objectives of Surveillance

There were three main objectives of the piloted elementary school injury surveillance system:

1. determination of the feasibility of using this system in the elementary school setting and evaluation of its effectiveness
2. increased understanding of the epidemiology of school based injury
3. development of injury prevention and intervention strategies.

The development of a systematic basis for assessing the magnitude of the injury problem in the elementary school setting and identifying risks associated with injury could, it was hypothesized, provide guidelines for the school safety planning process. In particular, information from an elementary school-based injury surveillance system could identify groups of students that might benefit from targeted intervention or prevention strategies (e.g. added supervision of younger children on the playground; modification of play equipment). Since it was hypothesized that many injury risks at schools are the same for less and more serious injuries, all injuries were reported to the system. This provided a greater number of injuries and, it was theorized, more likelihood of identifying associations between certain hazards and injury occurrence. This pilot project was implemented to not only provide answers but also to determine the questions that need to be addressed in deciding how to best deal with the problem of school-based injury from the public health, educational, policy and other related perspectives.

Time Period of Implementation

The pilot surveillance system was implemented over a three year period. Reference made in this report to specific time periods during which the project was ongoing will be as follows:

- *year 1* always refers to academic year 1993-94 starting in October of 1993, the earliest month of data collection for any school
- *year 2* always refers to academic year 1994-95 from September of 1994 through June of 1995
- *year 3* always refers to academic year 1995-96 from September of 1995 through June of 1996
- *year* always refers to the academic year extending from September through June

Monitored Population

The elementary students who were monitored for the duration of the project comprised students at the 15 Washington state elementary schools that participated in this pilot system. The schools were located in 5 non-urban school districts from 4 counties in the state. Though school district and elementary school selection were not done using a systematic sampling technique there was effort put into identifying districts that fulfilled certain general criteria and that would then be the source of schools that also fulfilled these criteria:

- non-urban with large urban areas excluded
- in counties with large enough local health office to provide a liaison capacity
- contributing to the geographic distribution of the study group(schools from eastern and western parts of the state)
- kindergarten through 12th grade (K-12) enrollment approximating the median for districts in the state (i.e. exclusion of schools that were very small or very large)
- inclusion of elementary schools with grade levels Kindergarten through fifth (K-5); exclusion of elementary schools with Kindergarten through sixth (K-6) grade level structure

The average annual Washington state district K-12 enrollment over the three years during which this project was in operation (1993-1995) was 3155 students. Fifty percent of the 296 districts in the state had a median school enrollment (K-6 facilities only) of 234 or more students.

Recruitment of the sample

Recruitment occurred primarily during the late spring and summer of 1993. Participation in this project was voluntary and, for all districts that met the above criteria, the ultimate decision about participation was made by the district superintendent. Through local health department personnel, information about the development of a pilot elementary school injury surveillance project was disseminated to school districts in their purview who fit the general criteria listed above. Project personnel presented more detailed information to interested district personnel and subsequently to school principals and staff.

To provide opportunity to as broad a group of schools as possible, information was disseminated to many districts throughout the state via the local health departments who are, by state statute, responsible for safety assessment at the schools. Within the districts that expressed interest in participating in this project, there were differing approaches to involving elementary schools. For two of the districts there was a decision at the district level and all elementary schools were strongly urged to participate (10/12 eligible elementary schools in these districts participated in the project). In the remaining districts there was support for participation but the decision was put into the hands of the schools.

In these districts 5/24 eligible elementary schools participated. In all districts the superintendent of schools assigned a liaison to work with project personnel, the district, and the local health department.

Injury (case) Definition

Reportable injuries were defined broadly and had the following characteristics:

- happened at school during regular school hours
- required some form of treatment (e.g. Band-Aid, splint, sent home, etc.)

Injury Reporting Form

A standard injury form (see Appendix 3C) was employed at each participant school to collect the following type of information for each incident:

- demographic information about injured student
- circumstances surrounding the event
- post-event circumstances including body part injured and type of injury

There were several features of this form that are important to note:

- grade level was recorded; birth date was an item on the form but was not used due to a decision by the project staff that this could lead to a loss of confidentiality; age was not included on the form and this information was not collected
- there were no unique identifiers used thus precluding any systematic assessment of duplication of injury incident reporting or of studying multiple injuries per student

Evaluating the Surveillance System

This report presents information which focuses on better understanding the epidemiology of school-based injury. The interpretation of the results of analyses of the data collected by the pilot surveillance system depends on many factors related to its effectiveness. In a separate report to DOH a systematic evaluation of the pilot surveillance system, using CDC guidelines, is presented. [1] The reader is referred to that report for a more complete discussion of data quality and its relation to system design and implementation issues.

For the purposes of this report, however, an overview of the more important evaluation results are presented to provide some background for interpreting and discussing the results of the analyses. The framework for assessing the effectiveness of the pilot surveillance

system was based on the seven following characteristics which have already been mentioned above:

- simplicity
- acceptability
- flexibility
- sensitivity
- predictive value positive
- representativeness
- timeliness

These are defined in the Glossary (Appendix 3E). The data collected from the surveillance system provided part of the information necessary to evaluate these characteristics. In addition to the data, however, there were also several other sources of information. These included the following:

- reports from site visits and personnel interviews conducted in May and June 1996 at each of the 15 participant schools
- written evaluations provided by participating school personnel using an evaluation form developed for that purpose
- school schedules (i.e. days in session; daily recess and lunch schedules) provided by participating schools(see Appendix 3D)

Sensitivity of case reporting to the system

The percent of school injuries that were reported to the system is a measure of the 'sensitivity' or 'completeness of coverage' of the system. Assessment of underreporting calls for a reference or 'gold standard' against which the injury data can be compared. Most of the participating schools maintained health logs in which a small amount of information (e.g. name, date, time, brief description of injury) about injuries and illnesses that happened at school were recorded. Injury reporting to the surveillance system and recording in the logs were, for several schools, done in parallel. For three schools, information from the health logs for year 2 was compared to that from injuries reported in year 2. These analyses compared the number of injuries reported in each of the two ways. It was not possible with the information and resources available for this project to specifically match log entries with injury project reports because for the latter reporting was anonymous.

Site visits and personnel interviews

Site visits to each of the 15 participating schools and interviews with the principal school project personnel were conducted by the project epidemiologist. At each of the 15 participant schools she observed case identification and injury data collection procedures. She also met with

school personnel responsible for data collection and, in most cases, also with the school principal.

Written evaluations

A pilot project evaluation tool was developed to obtain feedback from school principals, school project staff responsible for data collection and local health jurisdiction (LHJ) liaisons. It was distributed to them in May and June of 1996(see Appendix 3D), nearly at the end of the data collection period.

Data Collection

Period of data collection

Injury incidence information was collected at the schools starting in October 1993 and ending in June 1996. Four schools began data collection in October and November of 1993; nine started in January 1994; one in April, 1994; one in September 1994. The total number of months of data collection is shown for each school in the following table:

School	Start Date	Total Months of Data Collection
1	10/93	29
2	10/93	29
3	1/94	26
4	1/94	26
5	1/94	26
6	1/94	26
7	1/94	26
8	11/93	28
9	1/94	26
10	1/94	26
11	11/93	28
12	1/94	26
13	1/94 (end 11/95)	19
14	4/94	23
15	9/94	20

Data collection procedures and personnel

School personnel, usually the school secretary, were responsible for collecting information about each eligible injury episode and completing the injury report forms. These personnel were also responsible for ascertaining injury eligibility status for this project. Typically, the injured child was either sent into the school office for care or was treated on the playground or other outdoor setting if that is where the injury occurred. Regardless of where the injury occurred, the completion of the injury

report form by the office secretary or playground aide typically occurred in the school office or health room. Over the course of the project there were changes in personnel at some schools, while at others the personnel remained constant. There were several variations in the basic protocol that was used to monitor school injuries. Playground aides at several schools were responsible for treating minor injuries on site and thus may not have routinely completed injury report forms for these injuries.

At two schools, between years 2 and 3 of the study, a two-tiered procedure developed for reporting injuries. This procedure mainly involved injuries that occurred in outdoor locations that were monitored by playground supervisors. Playground supervisors carried injury forms with them. When injury incidents occurred, the portion of the report form dealing with circumstances of injury was completed on site; the form then accompanied the injured student into the office where treatment was administered and the post-event and demographic information sections of the forms were completed. Dependent upon the age of the injured child, he or she was accompanied by a teacher, an aide or another student when going to the office.

Data Flow

A chart diagramming the flow of information in this system from data collection to database development and report generation is shown in Figure 3.1. According to the project protocol, school personnel filled out most parts of the injury report forms shortly after the injury incident occurred. Completed injury reports were kept by the school project personnel and were periodically (usually quarterly) collected by the project consultant who was responsible, in collaboration with the LHJ liaisons, for the following:

- collecting completed injury reports from the schools
- preliminary edit checks including visually inspecting forms for completeness and inclusion of basic demographic information such as grade, gender, date and time of incident
- reviewing injury ascertainment and data form completion problems with school personnel and where feasible correcting errors while still at the school
- submitting the forms with completed preliminary edits to the state project coordinator in a timely manner

The diagram in Figure 3.1 shows that at some schools both surveillance system injury reporting forms and health log entries were completed for injury incidents. At schools with both reporting systems it is not clear whether injury incidents were reported in parallel or only on one or the other of the two systems. No documentation is available to systematically and reliably assess the magnitude of ‘double injury reporting’.

Data management staff at DOH were responsible for final review, editing, and coding of the injury reports prior to data entry. Grade, gender, incident date, and school were required items; forms missing this information were ineligible. However, there was an effort made to obtain missing information from the schools by resubmitting forms for completion. Some schools routinely kept copies of the injury reports, thus increasing the feasibility of obtaining this information.

Data from edited and coded injury report forms were double key entered from the injury reports into a Paradox (version 5.0) database developed specifically for this project. Additional logic checks were built into the data entry program and facilitated the further identification of errors. Injury forms with errors that had been identified through the edit and data entry processes were reviewed and corrected, if feasible. These forms were excluded from data entry if error correction was not feasible.

Data Analysis

Exclusion of incomplete or ineligible reports

A total of 2788 injury report forms were collected during the period from October 1993-June 1996. Of these, 2730 (98%) comprise the final analysis database upon which this report is based. Fifty-eight injury reports were excluded from the analyses for the reasons given below:

	Number of Forms
Missing Grade	36
Missing Gender	2
Missing Incident Date	4
Other	16
	58

Summarizing the results

For this report, descriptive analyses were used to summarize the injury data. Crude injury rates were calculated for each school and also for grade level and gender-specific groups within schools. The distributions of characteristics of injury such as location, time of incident, involvement of play equipment, etc. were presented as proportions and percentages. Summaries of aggregate injury incidence were presented as weighted averages and medians. The injury rate was expressed as follows: '*Number of Injuries per 100 Student-Years'.* The basic calculation for the injury rate was as follows:

Crude Injury Rate: I/D where I=total number of injuries

D=(student enrollment) x (number of academic years over which data was collection)

An additional adjustment was made in the kindergarten level denominators because of the half-day nature of kindergarten classes. The exposure of kindergarten children to school-based risks for injury was half that of other grade levels because they were in school about half the amount of time. Thus, for the kindergarten level denominators an additional calculation was done after the data collection time factor had been considered: the denominator was multiplied by 0.5. The Glossary in Appendix 3E contains more detail on the calculation of the crude injury rates and weighted average rates.

Confidence intervals, when used, were calculated by the method of Ury and Wiggins.[11] This was limited to within school comparisons over time and comparisons of like groupings of schools over time (e.g. comparisons of injury rates for each district over the three years of data collection). The calculation of 95% confidence intervals provided a statistical measure for the random variability of the rate estimates and were helpful in assessing whether the differences over time were due to chance. Since the data were not collected from a random sample of Washington state schools, the use of inferential statistical methods for between school comparisons of injury rates was considered inappropriate.

Analytic strategy

A multi-tiered approach was used in the analyses of these data. The presentation of the principal results falls into the following three categories:

1. a summary of the overall results
2. circumstances, mechanisms, and outcome of injury episodes emphasizing playground and playfield injuries
3. characteristics of playground and playfield injuries in schools that reported to the system more regularly

Intervention Study

Study design

After approximately one year of data collection, in September 1994, an intervention study was designed and implemented at the schools. It's goal was to assess the effects on injury incidence of playground surfacing changes or the implementation of a supervision training program at the schools. To study this, schools were divided into three groups, using a quasi-experimental design, which stratified initially on the following variables(school district was not controlled):

- injury rate during year 1(called the baseline rate)
- characteristics of equipment on playground (e.g. age of the equipment)
- changes taking place at a school during year 1 (e.g. addition of new equipment; introduction of a conflict resolution program into the curriculum)

Thirteen schools were randomly assigned to one of three groups that were defined as follows:

- one group experienced planned physical site changes (i.e. surfacing or equipment modification in accordance with 1991 United States Consumer Product Safety Commission (CPSC) guidelines)
- a second group experienced a supervision training program for playground aides, teachers and others at the school
- a third group comprised the controls who experienced no planned changes

The randomization procedure was done in two steps. Three of these thirteen schools had made some changes in equipment during year 1. They were the first to be assigned randomly to the above three groups. Then the remaining 10 schools were assigned randomly to these groups.

Because the project team believed that big equipment changes at the two remaining schools during year 1 had made them ineligible for inclusion in the random assignment to the above group these schools were put into a special group. Both of these schools were to receive planned site changes as well as supervision training. The rationale for this decision is discussed more fully in reports prepared for DOH by Thompson and Bruya. [9, 10]

Study groups

The final study groups were as follows:

	Number of Schools	Districts Included
Controls	5	A,B,C
Physical Site Change	4	B,C
Supervision Training	4	A,D,E
Special Group	2	B,C

Physical Site Changes [10]

A summary of the protocol follows:

- installation of 9 inches of wood chips under all playground equipment

- containment of all surfacing within barrier structure to hold it in place around equipment
- perimeter of surfacing containment no less than 6 feet from the furthermost point on equipment creating a safety zone
- negotiation with school and district regarding removal of equipment assessed as having potential for safety problems

Supervision training program summary [9]

- Five training sessions scheduled for October 1994, January 1995, September 1995, January 1996, and May 1996
- Program was for entire school staff including teachers and playground supervisors (the focus of sessions varied as did the target audience so that not all sessions were attended by the same people)
- Goal of the program was the teaching of the following three basic concepts to school supervision training staffs consisting of teachers and playground supervisors
    1. Protection
    2. Prevention
    3. Problem Solving
- Program took place at the schools

Evaluation of study

The reader is referred to reports on '*Supervision Training'* and '*Physical Site Changes'* by Thompson and Bruya for a more complete discussion of the intervention study.[9, 10] The injury data collected from the schools is presented by intervention group in the results section of this report as part of a brief presentation of the change in injury rate over time by intervention group[see Table 3.19].

RESULTS

The results of the analyses of the data collected during the three years of injury surveillance at the 15 participating elementary schools are presented in the figures and tables found in Appendices 3A and 3B. All injury rates are presented as '*Number of injuries/100 student-years'*. The academic years of data collection were defined elsewhere in this report.

Characteristics of Population Studied

Enrollment, race/ethnicity, gender

Enrollment data is collected annually by the Washington State Office of the Superintendent of Public Instruction (OSPI) for all schools in the state. The participating schools were not randomly selected. Nevertheless, it was useful to compare them with non-participating schools in the same school districts on the characteristics for which information was available.

The median average enrollment for the 15 participating schools was 449 students (range =273-540) while that for the 21 non-participating schools was 353 students(range=135-590) [Table 3.1]. All but one school in each of Districts B, C, and E participated in this project and so the information for these districts is well represented by the data collected from the participating schools. On the other hand, in Districts A and D the majority of schools did not participate in this project. However, the enrollment data in Table 3.1, as well as the race/ethnic group distributions presented in Table 3.2, show that the participating and non-participating schools in Districts A and D were similar for these characteristics. Table 3.2 also shows that District A (both participant and non-participant schools) had a much smaller proportion of 'Hispanic' students than the other districts (3.5% and 4.4% for participants and non-participants respectively). The 'Hispanic' enrollment in Districts B, C, D, and E was 3 to 7 times greater than this. Gender distributions for participant and non-participant schools were similar [Table 3.3].

Surveillance System Evaluation

Data quality

A comprehensive evaluation of the pilot school injury surveillance system is in preparation and will be available from DOH when completed. [1] The quality of the injury data collected was related to the effectiveness with which the system operated in meeting its objectives of estimating school injury magnitude risk associated with school-based hazards, particularly those on the playground and playfield that might be amenable to modification or prevention.

Evaluation of surveillance system attributes

The seven surveillance system characteristics were assessed. Though all are important to assessing the school injury surveillance system the most relevant for evaluating the effectiveness of the system were: completeness of coverage(sensitivity); representativeness; timeliness; simplicity; acceptability.

Completeness of coverage (underreporting), representativeness

The participating schools were limited to non-urban districts of Washington state. Since they were not a random sample of Washington state elementary schools, however, the injury information collected may not be representative of Washington state elementary schools in non-urban school districts. Almost all of the elementary schools in Districts B, C, and E participated in the project. Nevertheless, there was between school injury rate variation within each of these districts during each year of data collection. Table 3.4 shows that in Districts B and C there was much variation in year 1 injury rates (i.e. injury rate range for District B=2.5-109.7; injury rate range for District C=6.8-50.8). In addition, the data analyses summarized in Figure 3.2 and in Tables 3.4 and 3.5 show a decline in reporting during year 2 of the project. This decline was greatest for Districts B and C with little change from year 1 to year 2 observed for District A[Tables 3.4 and 3.5]. The most plausible explanation for these results is that underreporting was occurring, more at some schools than at others.

In addition to this evidence there were also, for three schools, health log data summaries for year 2 of data collection. For these three schools(# 3, 6, and 10), a comparison of the total number of injuries reported to the pilot surveillance system, in year 2, with the number recorded in the health log for the same time period, showed that there were fewer reported to the pilot project. A summary of these results follows(project=number of injury reports collected at the school by the pilot surveillance project; logs=number of injuries recorded in the school's health logs):

- school #3: project=108 logs=397
- school #6: project= 28 logs=163
- school #10: project= 1 logs=498

In addition to underreporting there was also evidence that data collected was not representative of the injury incidents that took place at some of the schools. For example, a decline in injury reporting at some schools in year 2 of the project was associated with an increase in the proportion of injuries that were treated off-site at a clinic or hospital(i.e. were more intensively treated). This was observed with schools 3, 6, 11, and 12 where the proportion of more intensively treated injuries in year 2 ranged from 3 to 20 times higher than that reported in year 1.

Timeliness

The diagram in Figure 3.1 shows that most of the collected injury data was transferred from the school to DOH by the state project consultant. Feedback, to the schools, of the results from the preliminary data analyses was an anticipated subsequent step in the surveillance system operation. As shown in the diagram there was a break in this part of the system which affected the timeliness of feedback to the schools. The ongoing documentation of problems ranging from those affecting data

collection and case ascertainment to those dealing with the coding decisions was affected.

Simplicity, acceptability

The qualitative characteristics of the surveillance system were assessed through on-site visits as well as personal interviews with school personnel, including the use of an evaluation form (see Appendix 3D).

The acceptability, flexibility, and simplicity of the system were reflected in the responses to the personnel interviews and evaluation forms as well as the project epidemiologist's assessment of the on-site arrangement for data collection. The project playground consultant and LHJ liaisons also provided some feedback over the three years of data collection.

Summaries of some of the comments received from these various sources include:

- the project was generally viewed as being a potentially worthwhile endeavor
- the injury form was generally viewed as being simple to fill out
- school project staff thought the project took too much of their time
- the case definition was difficult to interpret consistently
- lines of communication between the schools and DOH were not always clear
- the purpose of the project was not clear
- the project protocol did not take into consideration specific 'cultural' differences between the schools that might have affected implementation of the system
- the LHJ liaisons reported that their roles were not clear and they thought they could have been used more effectively
- visibility of the project (e.g. location of forms, specific procedures, involvement of the principal and district superintendent) varied considerably between sites

Scope of the project

It was not clear from the project documentation whether the protocol provided to the schools clearly indicated that all injuries were to be reported. Reviewing quarterly reports, communication between DOH and local entities, and other documents showed the project often referred to as '*The School Playground Injury Project'.* The scope of injury reporting had changed at some schools during the course of the project so that during some periods of time only playground injuries were reported while at other times all injuries were reported. The data collected, therefore, is likely to misrepresent the proportion of playground injuries that occurred at some schools. Selective reporting of playground

and playfield injuries may have led to a higher proportion of these injuries in the database than occurred at the participating schools.

Overall Results

Enrollment (denominator)

The data in Table 3.6 shows the overall and grade-specific average annual enrollments at the participating schools for the three years of data collection. The total average annual enrollment for the 15 participating schools for 1993, 1994 and 1995 was 6452 students. These enrollment figures were used to estimate the numbers of students that were exposed to injury risk at school. The calculation of crude injury rates used enrollment data as the denominator.

The participating schools in Districts A, B, and C each are K-5 schools with six grade levels. The total yearly combined enrollment in these 12 schools was approximately 5200 students. There were approximately the same percentage of students in each grade (i.e. each grade consisted of about 15% of the enrollment). District E schools with only grades 1-5 similarly showed an approximately equal distribution among the grades (i.e. each grade consisted of about 20% of the total enrollment).

Number of injuries (numerator)

The number of injuries reported to the system was used as the numerator to calculate the crude injury rate. There were 2730 injuries reported to the surveillance system that were eligible for inclusion in the analyses (see Methods: Data Analysis, page 16). The table below shows the distribution of injuries by grade level and academic year. The proportional distribution by grade level of the number of injuries reported to the system was approximately the same during each year of data collection. The median three year percentage of injuries by grade level was: kindergarten=6.1%; grades 1-3=57.0%; grades 4 & 5=37.2%. Though the proportional distribution remained stable, the actual number of injuries reported to the system declined during year 2 of the project even though the total number of months of data collection was greater during year 2 than during year 1.

Number and percent of injuries by grade level and academic year

Academic Year	Kindergarten N (%)	Grades 1-3 N (%)	Grades 4&5 N (%)	Total N (%)
1993-94	57 (6.1)	560 (60.2)	313 (33.7)	930 (100)
1994-95	38 (5.8)	373 (57.0)	243 (37.2)	654 (100)
1995-96	75 (6.5)	611 (53.3)	460 (40.1)	146 (100)
Total	170 (6.2)	1544 (56.6)	016 (37.2)	2730 (100)

Table 3.4 shows that 8 of the 15 participating schools experienced a large decline in the number of injuries reported during year 2 relative to year 1 (i.e. schools 3, 4, 6, 7, 8, 10, 11, 12).

Reporting consistency

Analysis of the data provided some information about the regularity with which each school reported injuries to the surveillance system.

The chart in Figure 3. 3 shows the proportion of total months of data collection during which there were no reports or less than 5 reports collected for each school. Review of the number of injuries reported per month for each school showed that some schools did not report any injuries at times. The per month number of injuries reported varied by academic year and school. The regularity of reporting, it was hypothesized, might reflect the effectiveness with which the system operated. To assess this, each of the 15 participating schools was assigned to one of the three groups established by creating a descriptive variable, '*Reporting Consistency'*, using the following data:

1. number of injuries reported to the system per month from September through May during the period of time from 1993 through 1996 when data was being collected for the surveillance system at a school.
2. total number of month of data collection for a school based on project documentation.

The months of August and June were excluded from this assessment. Typically school begins in September, however, for some schools during some years of the project school began at the end of August. Similarly, the end of the school year is in June but the actual number of days that school is in session during this month, as well as the specific school programming, varies considerably from school to school and within a school may be quite different from the rest of the academic year. Thus, it was decided to control for this additional source of variation by excluding August and June from the total number of months during which assessment of reporting consistency was done. For example, school #2 participated in injury data collection from October 1993 through June 1996, a total of 29 months. For the purposes of assessment of reporting consistency, however, the data from 26 months (exclusion of data from the month of June) were considered.

Group 1 consisted of four schools that showed the following reporting characteristics:

- $\geq$4 reported injuries for at least half of the months and $\geq$ 15 reported injuries for at least a third of the months during which data was collected
- at least one injury reported during every month of data collection

Group 2 consisted of two schools that showed the following reporting characteristics:

- ≥4 reported injuries for at least half of the months during which data was collected
- fewer than 5 months during the entire data collection period when no injuries were reported to the system
- ≥ 5 reported injuries per year of data collection.

Group 3 consisted of nine schools that showed one or more of the following reporting characteristics:

- < 4 reported injuries for more than half of the months during which data was collected
- ≥ 5 months during the entire data collection period when no injuries were reported to the surveillance system

Three 'Group 3' schools reported <5 injuries during at least one of the years of data collection.

Comparison of injury rates over time

School district policy and budget often affect school level issues such as the type and condition of play equipment at a school, school safety policy, school play schedules and curriculum, availability of school nurses, availability of playground supervision, time and days in schools, etc. In this report, analyses are often present at the school district level to control analytically for these differences.

Summary injury rates for groups of schools, such as those presented in Table 3.5 for participating school districts are the weighted average school rates. The overall summary crude injury rate estimated from the collected data was 17.6. For each school district the estimated injury rate and 95% confidence interval (95% CI) for each academic year of data collection is shown.

Over the three years of data collection the estimated injury rates for District B were as follows: year 1, 31.3; year 2, 7.2; year 3, 21.1. The general direction of variation over the three years was similar for injury rates for District C: year 1, 24.4; year 2, 7.6; year 3, 17.3. For Districts B and C there is no overlap in the 95% CI for each of the three years. The injury rate declined in year 2 and increased again in year 3. This variation in injury rates over time for these two districts is thus not likely to be due to random variation.

In District E the overlapping 95%CI's for year 1, year 2, and year 3 suggested that the observed changes in the injury rates were within the range of variation expected as a result of random variation. The injury rate estimates for this district were: year 1, 24.1; year 2, 15.1; year 3, 18.3.

The yearly injury rates shown for District A were: year 1, 20.3; year 2, 30.8; year 3, 24.6. The increase in injury rate from year 1 to year 2 suggests a different pattern than that which was observed for Districts B, C, and E. Comparison of the 95% CI's for the three years of data

collection in District A, however, suggests, as for District E, that the changes in injury rate over this time period was due to random variation.

Individual schools

The data presented in Table 3.4 shows, at the school level, the variation in school injury rates from year 1 through year 3 of data collection. Of the 14 schools that participated during all three years of the project (School 15 entered the project in year 2), there were 12 that reported at least 5 injuries during every year of data collection. The median school injury rate was 14.2 in year 1; 3.7 in year 2; 6.1 in year 3. The median school injury rate for the three years combined was 7.4. These medians were lower than the weighted average rates shown in the table. This reflects the between school variation and the large number of schools with very small numbers of reported injuries. Districts B and C, with 2/3 of the surveillance system's schools, were the source, as would be expected, of approximately 2/3 of the reported injuries. However, the table shows that these 1864 reported injuries were not, for each year, distributed equally among the schools. The ratio of the highest median injury rate to the lowest for Districts B and C (three years data combined), respectively, was 24 and 7.

The weighted average injury rates, as well as the median rates, showed a sharp decline from year 1 to year 2. These summary measures reflect the experience of 7 schools (i.e. schools # 3, 4, 6, 7, 8, 11, 12) . Five other schools (i.e. schools #1,2,5,9, 14) showed more stable injury rates over time. Each of three of these five schools (#1, 2, 14) reported a total of over more than 100 injuries to the system during three years of data collection.

Grade and gender

Table 3.7 shows the median district grade and gender-specific injury rates estimated from data collected at the participating schools. The injury rate for boys climbed from 17.0 in kindergartners to 22.4 in grade level 4 & 5. Girls were injured at a more constant rate from kindergarten through 5th grade. The injury rate for boys was about the same as that for girls in kindergarten through 3rd grade. In the 4th and 5th grade levels combined, however, the results showed about a 40% higher injury rate for boys relative to that calculated for the girls.

Injury rate variation by season

The chart in Figure 3.2 shows the weighted average school injury rates for each season during the three years of data collection. The year 2 decline, already mentioned above, occurred during each season with corresponding increases in injury rates during year 3. The 95% CI for year 1 and year 3 overlap for Fall and Spring suggesting the effects of random variation. The injury rate for the winter of year 1, nearly 2 fold higher than the winter rate of year 3, stands out in comparison to the

other data. Winter of year 1 was the season during which 9 of the 15 participating schools began data collection.

Circumstances and Mechanisms of Injury Events

The circumstances and mechanisms of injury events refer to the following issues:

- When did the injuries occur?
- Where did the injuries occur?
- Did the injuries involve playground equipment, falling, interaction with other students, or involvement of an object such as game equipment or a rock?

When injuries occurred

About 73%(n=1998) of the 2730 elementary school injuries included for analysis happened between 8:30 AM and 1 PM. Overall, more than 50% of these (n=1157) happened during the 11 AM to 1 PM time period. For kindergartners, however, more than 50% (n=87) of the reported injuries occurred earlier, between 8:30 and 11 AM. This general pattern was similar for playground/playfield injuries also. Some information on the recess schedules for at least one year of data collection was available to this project for 11 of the schools. There was variation among the schools in some of the specific features of recess scheduling including but not limited to the following:

- the number of recesses per day for students in grade levels 1-5
- the scheduling of recess during lunch period
- the scheduling of afternoon recess for grade levels 1-5

In general there was some consistency in the length of morning and afternoon recesses (usually about 15 minutes) and the lunch recess (usually about 25-30 minutes).

Where injuries occurred

Table 3.8 shows the distribution of reported injuries for each year of data collection by location of the injury incident. The injury reporting form (see Appendix 3C: injury reporting form, Item 2) included two categories for location that were related to the outdoor play environment: playground with equipment (Value='1'); playfield (Value='2'). Because it was not clear how these categories were interpreted by the school project staff at each school. It seemed that there may have been overlap in the coding that was used for playground injuries and so it was decided to combined these two codes for the analyses. The combined category was called 'playground/playfield'. The proportion of injuries that occurred on the playground/playfield was about the same for all three years of data collection. Overall there were about 67% of the 2730

injuries available for analysis that occurred on the playground/playfield; another 15% occurred in some other outdoor location; and 17% occurred indoors.

Playground equipment

Preliminary information was provided from playground equipment assessments that had been done by DOH at the 15 participating schools. This information is not yet available in a form that can be linked to the injury data for analysis. It was, nevertheless, possible to prepare a preliminary descriptive summary of the total number of pieces of each type of play equipment at the participating schools. The total relative numbers of pieces of play equipment types at all the participating schools was compared to the relative frequency of injuries on these types of equipment.

There were 254 pieces of equipment at the 15 participating schools with over 90% of the following types (presented in the order of decreasing total numbers at the schools):

- spinners
- climbers (excluding the spinners and dome climbers)
- overhead apparatus
- structures
- tire swings
- dome climbers

The distribution of the 738 reported equipment related injuries by type of equipment follows(presented in decreasing percent of total number of

equipment related playground/playfield injuries):

- structures
- overhead apparatus
- tire swings
- climbers (excluding the spinners and dome climbers)
- spinners
- dome climbers

CHARACTERISTICS OF PLAYGROUND/PLAYFIELD INJURIES

The overall percent of reported playground/playfield injuries was presented in the previous section (i.e. 67.3%). This estimate was similar for each of the participating school districts. This is reflected in the district proportion of playground/playfield injuries reported to the system which was 70.9% (range: 58.4%-78.9%).

Intensity of treatment

The proportion of playground/playfield injuries that were more intensively treated (i.e. treated off-site at a clinic or hospital) was comparable to the total number of injuries that were treated this way [Table 3.9]. For all three years of data collection combined about 9% of all injuries, and 11% of playground/playfield injuries, were more intensively treated. As has already been pointed out, there was a decline in injury reporting during year 2 of data collection. The percent of playground/playfield injury incidents that were more intensively treated doubled in year 2 to 18% from 9% in years 1 and 3.

Distribution by grade level

The grade level distribution of playground/playfield injuries is presented in Table 3.10. Of the 1837 students reported to have been injured on the playground or playfield, 122 (6.6%) were kindergartners, 1098 (59.8%) were in grades 1-3, and 617 (33.6%) were in grades 4-5. This injury distribution by grade level was comparable with the enrollment distribution by grade level once the half-day exposure of kindergartners was taken into consideration [Table 3.6].

Including analyses from all participating schools, about 52%(n=63) of the injuries to kindergarten level students happened between 8:30 and 11 AM. By contrast, 50% (n=545) of 1st through 3rd grade injuries and 46% (n=285) of 4th and 5th grade injuries occurred during the 11AM-1PM time period. As has been previously mentioned, the 11AM-1PM time period included the lunch recess at many schools. This was typically about 30 minutes in length and affected most of the students in grades 1-5.

By contrast, the morning kindergarten level students completed their classes by about 11 AM and the afternoon kindergarten classes typically started at about 1 PM. These students were thus typically not at-risk of injury during the 11 AM-1 PM time period.

Association with falling

Falls were reported in over 50%(number of falls=964) of the 1837 injury incidents that occurred on the playground/ playfield injury incidents [Table 3.11]. About 59% of these falls occurred at ground level. On the playground or playfield, however, 41% of the injury incidents in which falling was involved occurred from elevated heights.

Variation between school districts

A comparison of the percentage of falls from elevated height relative to those occurring at ground level can be seen in the analyses presented in Table 3.12. The relative percentage of playground/playfield injuries involving falling was similar for all districts and was about 50%[Table 3.10]. However, the ratio of falls from elevated heights to those at ground level was nearly 2 for fall related injury incidents reported from

District A. This differed from the experience reported by Districts B, C, and E. For each of these Districts the injury incidents involving falls were more frequently reported to have occurred at ground level and not from an elevated height.

Grade levels

For each participating school district the greatest proportion of falls from an elevated height was reported for the lowest grade levels [Table 3.12]. For example, in District A, considering all playground/playfield injuries involving falling, about 90% of kindergartners, 62% of 1st through 3rd graders, and 58% of 4th and 5th graders were injured in falls from elevated heights. District E, with no kindergarten, showed a similar relationship between grade levels: 52% of the 1st through 3rd graders fell from elevated heights while only 41% of the 4th and 5th graders whose injuries involved falling reported a fall from an elevated height.

More intensively treated

The diagram in Figure 3.4 shows that about twice the number of reported playground/playfield injury incidents that involved falling were treated more intensively (i.e. off-site treatment at a clinic or hospital) compared to reported injuries that did not involve falling.

Play equipment

Overall, about 40% of the playground/playfield injury incidents reported the involvement of play equipment. The district-specific estimates for play equipment related injury incidents ranged from 30% to 60% [Table 3.13].

The reported involvement of play equipment in playground/playfield injuries declined with increasing grade level. The median district proportions by grade level of reported equipment related playground/playfield injuries were:

- 62.5% for kindergartners
- 52.6% for grades 1-3
- 32.0% for grades 4 and 5

District A, reported the highest percent of equipment related playground/playfield injury incidents (i.e. 52.5%) [Table 3.13]. The proportional distribution of equipment involvement by grade level was similar for all districts with more equipment involvement reported for the younger children than the older children. However, for District A, the actual percent of reported equipment involvement was higher at each grade level than for the other school districts included in these analyses.

Involvement of structures, tire swings, overhead apparatus, climbers

Eight-two percent(n=608) of the 738 playground/playfield injuries reported to involve play equipment specifically identified the following types of equipment:

- structures
- tire swings
- the overhead apparatus
- a type of climber

Table 3.14 presents the data for the playground/playfield injuries that reported involvement of these four types of equipment. It has already been mentioned that the grade-specific involvement of equipment in injuries varied with a higher proportion of the younger children's injuries involving equipment than those of the older children. Nevertheless, the proportion of injuries involving each equipment type was similar for each of the grade level groups and was approximately as follows [Table 3.14]:

- 1/3 of injuries involved a structure
- 1/3 involved a climber
- 1/6 involved a tire swing
- 1/6 involved an overhead apparatus

More than 1/3 of the climber involved incidents reported specific involvement of spinners.

Description of types of injury

Ninety-four (13%) of the 738 equipment involved injuries were treated more intensively (i.e. off-site at a clinic or hospital). There were 799 injured body parts with a total of 821 types of injury damage report for these equipment involved injury incidents. Table 3.15 presents the distribution by body part injured and type of injury damage for these 821 injuries. Nearly 50% of the reported injuries involved the head, face and neck (including the mouth, jaw, and eyes). About 20% of the reported injuries involved upper extremities (i.e. arm, hand, wrist) and another, approximately 20% involved lower extremities (i.e. leg, foot, ankle). Though the head area was most the most frequently reported injured body part, the percent of more intensively treated injuries (i.e. off-site treatment at a clinic or hospital) was greatest for injuries of the upper extremities(i.e. about 30%). During the three years of data collection there were 28 injury incidents (i.e. 4% of 738 equipment related playground/playfield injury incidents) in which a student's arm, hand or wrist was reported to have been dislocated or broken and which was treated off-site at a clinic or hospital.

Association with interactive behavior

About 46% of the 1837 playground/playfield injuries reported involvement with another student. Assessment was made of the type of interactive behavior in which a student was engaged when an injury incident occurred. The injury reporting form specified two specific types of interactive behavior for those students injured while interacting with another student (see Appendix C: Injury Reporting Form, Item 3). Of the playground/playfield injuries that involved another student, about 67% reported ' playing'. Only about 16% reported injuries involved with 'fighting' or 'misbehaving' [Table 3.17].

Association with objects

Objects such as baseball bats or other game equipment were involved with about 15% of the 1837 playground/playfield injuries (n=271).

Play equipment and falling

As has already been presented, about 40% of the 1837 playground/ playfield injuries reported involvement with play equipment. Table 3.16 shows that 60%(N=443) of these injuries were associated with falling. More than 80% (n=368) of these 443 injuries reported falling from an elevated height. A large proportion of 1089 injuries that did not report equipment involvement also reported association with falling (n=516; 47%). However, only 29(6%) of these 516 injuries reported falling from an elevated height. Equipment associated playground/playfield injuries reported falls from an elevated height nearly 20 times as often as those that did not involve equipment.

More intensive treatment for falls from elevated heights

Nearly 20% of the 368 equipment related playground/playfield injury incidents that reported falling from an elevated height were treated off-site at a clinic or hospital.

Falling from specific types of equipment

The structures, climbers, overhead apparatus and tire swings were the types of equipment identified for about 85% of the equipment associated injuries. Overall, of the 363 injury incidents reporting falling and involvement of these four types of equipment, 310(85%) were from an elevated height. Seventy-eight percent of the 102 injuries involving the structure, 99% of the 75 overhead apparatus injuries, 90% of the 142 involving climbers and 64% of the 44 injuries associated with tire swings reported falling from an elevated height. Spinners and dome climbers accounted for about 60% of all climber related injury incidents. Fifty-two(96%) of the 54 spinner associated incidents and 29(88%) of the 33 dome climber incidents reported falling from an elevated height.

Injury characteristics of falls from specific types of play equipment

Fifty-five (18%) of the 310 playground/playfield injury incidents associated with falling from an elevated height and related to structures, climbers, tire swings or the overhead apparatus, also reported more intensive treatment off-site at a clinic or hospital. Twenty-one(28%) of the 74 overhead apparatus related injuries that involved falling from an elevated height reported treatment at a clinic or hospital.

Type of surface

The type of surface onto which falls occurred was reported on the Injury Reporting Form (Appendix 3C). About 70% of the injury incidents involving falling and play equipment reported falling onto either loose material or a grass/dirt surface. Another 17% fell onto play equipment. Although most of the playground/playfield injury incidents with falls that were not equipment related occurred onto a grass or dirt surface, nevertheless, about 1/3 reported falling to a hard concrete or blacktop surface.

Reported interactive student behavior

Figure 3.5 shows the proportion of injury incidents that reported involvement of another student, grouped by equipment and fall involvement. Playground/playfield injuries that reported involvement of play equipment showed about the same percentage of involvement with other students independent of the falling status. For injury incidents that were not equipment related, however, when falling was not reported , 76% of the injuries reported the involvement of another student compared to only 48% for injuries reporting falling.

Outdoor Locations Other Than Playground/Playfield

About 15%(n=398) of the 2730 injuries reported to the pilot injury surveillance system took place in an outdoor location other than the playground or playfield('other outdoor injuries') [Table 3.8]. About 60% of the 'other outdoor injuries' involved falling. There was a greater percentage of injuries reporting falling at each grade-level in each school district for 'other outdoor injuries' than for the playground/playfield injuries. As shown in Table 3.18, for the 'other outdoor injuries', approximately 86% of those affecting kindergartners, 65% of those affecting 1st through 3rd graders and 55% of those affecting 4th and 5th graders reported a fall.

Type of surface

More than 75% of the 244 'other outdoor injuries' that involved falling reported falls to a hard concrete or blacktop surface. Twenty-eight of these injuries (about 15%) were treated more intensively (i.e. off-site in a clinic or hospital). These included seven reported breaks or dislocations

(5 of these affected the arm, hand or wrist) and three injury incidents reported that the injured student lost consciousness.

SCHOOLS WITH MORE CONSISTENT REPORTING

The results presented in Table 3.4 identify six schools that reported injuries to the pilot surveillance system more consistently during the three years of data collection than the other 9 participants (see Results: Reporting Consistency; Table 3.4: Footnotes). More than 80% of the total number of injuries reported to the surveillance system during the three years of data collection came from these six schools. The proportion of all injuries reported to the system that came from these schools increased each year of data collection from 76% in year 1 to 82% in year 2 and finally to 90% in year 3. The weighted average injury rate and 95%CI for these schools by year of data collection was as follows:

- 1993-94 40.9 (95%CI=37.9-44.0)
- 1994-95 21.4 (95%CI=19.6-23.3)
- 1995-96 40.3 (95%CI=37.5-42.8)

In addition to reporting more consistently, three of the six schools did not show the sharp decline in injury rate in year 2 that was evident in data collected from the remaining schools. Again, looking to Table 3.4, schools # 1, 2, and 14 (located in school districts A or E) all showed little or no decline in injury rate from year 1 to year 2. In fact, both schools #2 and 14 showed a slight increase in injury rate over this time period.

By contrast, however, schools #3, 11 and 12(located in school districts B and C) all showed a decline from year 1 to year 2 ranging from about a 50% drop in injury rate for school #11 (year 1: 30.5; year 2: 16.6) to a 90% decline for school #12 (year 1: 50.8; year2: 3.4). Though the injury rates at these three schools did not return to year 1 levels, nevertheless, for two of the schools, there was an increase to more than 80% of the year 1 estimate. The injury rate estimate for school #11 remained constant at the year 2 level which was about 50% of that determined from injury data collected in year 1.

Playground/playfield injuries

The median three-year combined percentage of playground/ playfield injuries assessed at these six schools was 70% (range: 52-76%). For five of the schools the percentage of playground/ playfield injuries was similar for each year of data collection. The injury data collected at school #2, however, showed an increase in the percentage of playground/playfield injuries from about 50% in year 1 to nearly 70% in year 2.

Play equipment and falling

The equipment involvement assessed for playground/playfield injuries reported from the six schools that were more consistent in reporting was similar to that reported for all schools combined. The median school percentage for all three years of data collection was 47.1% (range: 28.7-56.7%). More than half of these 625 injuries (n=360) reported falling with about 80% of these from an elevated height(n=295). About eighty-five percent of these 295 playground/playfield injuries that involved play equipment and reported falling from an elevated height reported involvement of the following types of equipment:

- structure (n=65)
- overhead apparatus (n=60)
- spinners (n=45)
- other climbers (n=33)
- tire swing (n=27)
- dome climber (n=24)

Twelve percent of the 295 injury incidents that reported falling from an elevated height were more intensively treated. More than 20% of playground/playfield injuries involving equipment and falling at school #3 were reported as more intensively treated (i.e. off-site treatment at a clinic or hospital).

INTERVENTION STUDY

Table 3.19 presents the median school injury rates for each of the study groups of the Intervention Study. It can be seen from these results that the control group injury rate was lower than that of the other groups for each of the three years of data collection. This includes results from year 1 during which baseline information was to be collected. As was noted for 8 of the participating project schools, there was a year 2 decline in the median injury rate observed for three of the four study groups:

- controls
- physical site change
- special group

The study was initiated at the beginning of year 2. There was variation in the actual time of implementation of the various interventions. The physical site changes took place over the year from the fall of 1994 to August 1995. The decline in injury rate observed during year 2 of data collection does not coincide with actual changes in surfacing at all of the schools in the study group. During year 3, when in fact modifications had been completed at all 'physical change' schools, there was little change in the observed injury rate.

Supervision training began in the fall of 1994 and comprised an extended program that continued for the remainder of year 2 and into year 3. There was a great deal of variation in the degree to which individual schools in the supervision training group adhered to the program's protocol and so it was difficult to evaluate its effectiveness. [9] The supervision training group showed little change in injury rate over the three years of data collection.

Evaluation of the Intervention Study for DOH concluded that, among other problems, there were too many potential confounding factors that affected the observed study group injury rates. It was thus not possible to achieve meaningful estimates of the effectiveness of the interventions. The reader is referred to the reports prepared for DOH for more details about the intervention study and it's interpretation. [9, 10]

Discussion

LIMITATIONS OF THE PROJECT

The results from this project provide information about the design and implementation of elementary school injury surveillance. They also add to the understanding of the magnitude and characteristics of the injury problem in the elementary schools studied while generating some hypotheses that, if tested, could help to identify better ways to assess the problem and to prevent it. There were some important limitations to this project that affected its usefulness as well as the interpretation and implications of the results. Before continuing with the interpretation of the injury data analysis results these will be discussed.

Limitations of this pilot project related primarily to the following:

- implementation of the surveillance system
- typical problems inherent in the study of injury epidemiology
- limited resources resulting in study design and implementation issues.

Implementing the surveillance system

The surveillance system was not consistently implemented at all schools over the duration of the study.

Underreporting of injuries

There was evidence from the participating schools that not all injury incidents that occurred were reported to the pilot surveillance system. The results of such underreporting would be an underestimate of the total injury incidence at a school. The evidence for underreporting included the sharp decline in injury reporting observed for many of the schools over time, the difference in the number of injury incidents reported to the surveillance system compared to those entered into health logs at three of the schools, and the variation in injury rates observed between schools. Underreporting is not the only explanation for these observations. Nevertheless, it is a plausible one.

Case definition

The case definition was broad and nonspecific. It was thus difficult to provide objective instructions that were detailed enough to allow for its consistent interpretation at all schools. All injuries requiring any treatment were to be reported to the system. For injuries that were subjectively viewed as being ‘minor’, there was apparent variation from

school to school in the interpretation of the term '*requiring any treatment*'. For example, the application of an 'ice pak' to a wrist injury might be interpreted as 'treatment' at one school and as 'tender loving care' at another. This injury would thus be reported from the first school but not the second. Without a source of external validation for the case identification procedure it was not possible to accurately assess the effects of this problem. The implications of this type of differential reporting for the distribution of injury characteristics in the database are thus important to consider in interpretation of the results of the data analyses.

Scope of the project

Early project documentation consistently referred to it as a 'Playground Injury Prevention Study' and well after the completion of data collection this term was still often used. Nevertheless, school project staff reported, as part of the surveillance system evaluation, that they understood the scope of this project to include the report of all injuries that took place at the school. Whether this ambiguity was reflected in the implementation of the surveillance system and, thus, in the injury reporting criteria was an issue that remained unresolved. Because of this problem, playground/playfield injuries were possibly disproportionately represented among the injuries reported to the surveillance system.

Bias and confounding

Selection bias, misclassification and confounding may all be reflected in the injury data available for the analyses and thus also in the results presented.

Selection bias occurs when injuries are selectively reported to the system dependent on any one of a number of other factors such as gender, grade, type of activity, intensity of treatment, location of the incident. As mentioned above, the selective reporting of playground/playfield injuries to the system would result in an injury database with a distribution biased towards injury incidents that took place on the playground or playfield and not representative of the actual distribution by places where the injury incidents occurred. A similar logic would be applied to injury data that appeared to be associated with other sources of bias.

Information bias or misclassification occurs when the injury information collected on the injury reporting forms is affected by other factors under study. For example, if injuries to boys were reported more often as having involved 'fighting' while girls' injuries were more often reported to have involved 'playing' then a relationship between gender and 'fighting' or 'playing' would be observed. For the sake of discussion, let's assume that this relationship was a result of the subjective judgment of the school project personnel responsible for injury reporting rather than an actual record of observed injury circumstances. These results would

thus reflect information bias. In this example a misinterpretation would be likely: that there was an association between gender and the type of interactive behavior associated with the injury incidents. Without external sources of information validation there was little evidence from this project to affirm or deny the presence of information bias. Nevertheless, it was deemed important to consider the potential affects of information bias for the interpretation of the injury data reported to this system.

Confounding by a third factor may have resulted in observed associations between injury incidence and other factors. For example, it is possible that observed school district differences in play equipment involvement for the reported injuries may reflect variation in socioeconomic factors that affected both district specific access to play equipment and injury incidence. Measures of socioeconomic factors relevant to the student populations that were monitored were not readily available to this project. Confounding, as well as information bias, may have affected the results and needs to be considered in their interpretation. Evidence for these effects was not as readily available as was that for selection bias.

Epidemiology of injury

Studies of injury epidemiology are often affected by issues related to the following:

- identification of an appropriate denominator to use in estimating injury rates
- assessment of injury severity
- assessment of injury outcome including treatment and short-term and long-term affects

Denominator

The injury incidence rate was expressed as the number of injuries per 100 student-years. The denominator was a measure of the number of students '*at risk*' of injury per year of the project. '*At risk*' status implies that a student can be exposed to risk factors potentially associated with injury. For example, equipment related injury occurrence should be determined for those students that are in a location and time period where equipment related activity, and thus associated injury, is possible. Playground injuries should be determined for those children who are on the playground. Assessment of school injury incidence requires that children be in school and that school be in session.

It was not possible through this project to assess the actual exposure of each student to the risk of sustaining injury at school because the data needed to do so was not available. For example, the numbers of children playing with specific types of play equipment over a measured period of time was not assessed. School enrollment data, however, was

available as were the total number of days that school was in session. For some schools there was also grade-specific recess and play activity scheduling information available.

The denominators for calculating injury rates for this study were derived from enrollment data. Injury rates were calculated for schools and within schools for gender and grade level groups. Specific circumstances and characteristics of injuries reported were presented as percentages of the total rather than as rates because the '*at risk*' number of students could not be determined.

Severity of injury

Injuries that were reported to have been treated off-site at a clinic or hospital were assumed to have probably been more severe than those that were treated at school or were simply reported as having been sent home without any other information. However, limitations in the resources available to this project did not provide for an external source of validation for this assumption. Since the project, as it was implemented, did not provide a reliable way to directly assess injury severity, the reported treatment was, in effect, identified as an indirect indicator of injury severity. There is probable misclassification inherent in this process. Though the extent of error cannot be measured, it is especially important to consider this issue since the results from this project show association between treatment intensiveness and other injury characteristics.

Treatment and outcome of injury event

Related to the issue of assessing injury severity was that of determining the immediate treatment, as well as any subsequent treatment that was needed. Feedback from school project personnel suggested that there were injury incidents that did not appear to require immediate treatment but that eventually were found to be more severe. On the other hand, the reverse also appeared to have occurred. The relative frequency with which this misclassification of severity occurred could not be systematically determined from information available to this project. As for the issue of severity, there were no resources provided to consistently validate the treatment for reported injuries and to obtain accurate assessments through follow-up of the outcome of an injury event. The '*number of days missed from school'* was included on the injury reporting form which indicates that the project team intended to do some follow-up to obtain this information. In effect, this could not be done due in great part to the limited resources available to the project for this activity.

Basic study design and resource issues

Organizational structure

The project design was highly collaborative. Due to the many organizations involved and project staffing issues, a strong centralized coordinating function was missing. This particularly affected the integration of the data management component of the pilot system with the injury reporting component.

Data flow

There were barriers to the timely flow of injury information reported to the system and in feedback to the schools. The project data management procedures were not fully implemented until after completion of data collection. Thus the ongoing data quality issues that arose during the three year course of data collection were not consistently resolved and the documentation of decisions made was difficult or impossible to find. As previously mentioned, the protocol was difficult to integrate into the regular operation of many of the schools. It was also difficult for the project field consultant to oversee data collection, as well as oversee most of the other aspects of the project implementation at the schools.

School playground equipment and play environment information

School playground equipment and environment assessments were not available in a coded form. This information thus was not readily accessible in a form that could be integrated with the injury data and included in the analyses of those data. This was unfortunate since the predictors of injury at schools are likely to be associated with characteristics of the environment (i.e. playground equipment characteristics such as height; play environment characteristics such as the type of playground surfacing).

INTERPRETATION OF RESULTS AND CONCLUSIONS

This elementary school injury surveillance system met with some difficulties that were not dissimilar from those suggested by other studies. Underreporting and between school variation were both observations reported from a study of playground injuries at 68 elementary schools in a large Arizona school district over a two year period. [2] Most of the other studies reported in the literature have also been limited, as were we, in the choice of denominator data available for the calculation of injury rates. For example, to appropriately assess equipment related injury incidence, data relating to the use of play equipment would be needed. Collecting data on children's use of play equipment over timed intervals would be a costly venture and was not part of the regular injury monitoring protocol at any of the schools.

A better understanding of the predictors for between school variability might help to identify risk factors associated with injury occurrence. This information also could help in identifying more clearly those system factors (i.e. acceptability; simplicity; injury reporting form characteristics; etc.) that were associated with injury reporting and data quality issues at the different schools. Incorporating more information about a school (i.e. descriptions and assessments of play equipment at each school; scheduling information for play activities; supervision protocols for play activities; etc.) into a compatible project database could facilitate this type of exploration in other similar projects.

From the results of the injury data analyses, the association observed between grade-specific injury levels and time of day serves as an example of the advantage that would be provided by linkage of school environment, curriculum, and scheduling information to the injury database . The majority of reported injuries occurred during the 11AM to 1PM time period for 1st through 5th graders but during the 8:30AM to 11AM time period for kindergartners. Examining the actual grade-specific exposure to injury, there is a plausible explanation for this finding. Kindergartners are not generally on the school grounds between 11AM and 1PM. The length of lunch/recess is typically twice as long as the morning recess thus providing 1st through 5th graders twice the time in which they can be injured. Beyond this, however, the information available to our project cannot provide any help in determining why one school or district might have more injuries than another or why these injuries might be different. The typical recess schedules vary among the schools and the results of the analyses do not show whether the above explanation would be logical in the context of the injury findings and the recess schedule at each school. In order for this finding to be useful to a school injury surveillance system in identifying the associated risks with the goal of reducing them, it would be important to better understand the underlying factors affecting these results. These might include supervision issues, scheduling issues, play equipment condition issues and others.

Can this pilot system be used to monitor injury incidence in elementary schools?

A basic question posed by this project was: 'Can this pilot system be used to monitor injury incidence in elementary schools'? The results were equivocal. More than 2500 injury incidents were reported to this system and from the information obtained some description of the characteristics of injuries occurring at the participating schools was possible.

Since underreporting was evident, as was selection bias, it is likely that the results from this project underestimated and were not representative of all injuries at the participating school. The variation between schools and districts that was observed for injury rates, as well as for some of the circumstances of injury(e.g. the percent that were equipment related) is difficult to interpret without more information about what was going on at

the schools, what the condition of their playground equipment was, how their play activities were structured and other issues.

Limiting our analyses to only those six schools that reported to the system more consistently was an attempt to reduce this between school variation. The results from this stratified analysis did not differ greatly from those obtained by analyzing injury data from all of the schools. This limited analysis, however, did provide some ideas for modifications in an elementary school injury monitoring system that might enhance its effectiveness. It is, of course, still possible that underreporting and selection bias were operating at these six schools. Even if true, however, these six schools implemented the project in a way that resulted in regular reporting of injury and overall in reporting greater numbers of injury incidents. In general each of these six schools, when compared to the other 9 schools, used a more centralized coordination of the project with one person consistently in charge for the entire data collection period. Strong leadership from the principal was also apparent at most of these six schools. A better understanding of the role that these and other system characteristics play in elementary school injury monitoring would help in the development, as needed, of other similar systems structured so as to more effectively meet their objectives..

We were not able to arrive at a reliable estimate of injury incidence in the 15 schools that participated in this project. Nevertheless, the injury data analyses resulted in some interesting observations about the circumstances and mechanisms of the reported injury incidents. Hypotheses suggested by these results would, if tested, help us learn more about the epidemiology of school-based injuries at the elementary school level. With the addition of information about potential risk factors (e.g. condition or height of equipment), some rational strategies for school-based risk identification and evaluation of methods for risk reduction in the elementary school setting might be possible.

Comparability of results to other studies

Injury characteristics that were reported were consistent with findings from other studies. Other studies have limited injury reports to those that required more intensive treatment (i.e. were sent home, required the care of a physician, etc.). The rate of more intensively treated injuries from our study was 2.1 injuries per 100 student-years. In a study of one Washington state school district from 1986-88 and another of a large urban school district in Arizona from 1980-82, rates of 2.8 and 3.8 injuries per 100 student-years, respectively, were obtained for the elementary school students included in these studies. [2, 12] In addition, as was observed in these other studies our results also showed that a large percentage of injuries involved falling and playground equipment (especially climbers) and that injuries to the head and the upper extremities were the most commonly reported affected body parts.

Gender and elementary school injury

Overall, the risk ratio of injured boys relative to girls in our study was about 1.3 (see Table 3.7). This was consistent with the findings from a study of a Colorado school district in 1988-89 [6] as well as the 1986-88 Washington state study.[12] A unique contribution from the analyses of our injury data was the finer stratification by grade to determine the ratio by grade level of injured boys relative to girls. For kindergarten through 3rd grade our data showed no difference in the injury rates of boys and girls. Only in the upper grades (4th and 5th) did the boys have a higher rate of injury than the girls. Other studies have used broader grade groupings (i.e. elementary, middle and high school). Our findings suggest that with finer levels of stratification the association of gender with injury may not be observed at the lowest elementary school grade levels. There may be developmental as well as school program implications of this observation that could be useful in considering school safety issues.

Our injury data also suggested that injuries to the upper grade boys and girls were less often associated with playground equipment than injuries to students in the lower grades. At each grade level, however, play equipment involvement was more often reported by injured girls than by the boys who were injured. Whether this differential represents a real difference in play patterns at school or, possibly, results from other factors such as information bias, remains as a question for future investigation.

Playground and playfield injuries

Nearly 70% of the reported injuries from our study took place on the playground or playfield. This was similar to the percent of playground injuries observed among elementary school students in the 1986-88 Washington state study already mentioned. [12] It had been suspected that the scope of our project was misinterpreted by some of the schools, leading to over-reporting of playground and playfield injuries. Comparable findings from another study, however, bring this suspicion into question. Unfortunately, it is difficult to interpret the comparability of that study's results with our own. The problem of selective reporting may be reflected in the results of the earlier study. It is also possible that the over-reporting of playground and playfield injuries was less than suspected. In any case, the information collected on the injury reporting form was most relevant for playground/playfield injuries. It also appeared that this group of injuries was identified more consistently than those taking place in other school locations. Because of these factors the major emphasis of our data analyses has been to characterize playground/playfield injury incidents using the categories available to us from the injury reporting form.

Playground equipment and environment

Results from the analyses of our injury data suggested that injuries associated with certain types of equipment were more severe in nature (i.e. treated off-site at a hospital or clinic). While only 13% of all of the equipment related injuries were more intensively treated, 28% of those injuries associated with the overhead apparatus and 20% of those associated with spinners were so treated. Nevertheless, the findings of heightened intensity of treatment reported for injuries associated with certain types of equipment generate questions about the play behavior on the equipment, the details of the circumstances of the injury incident, and the condition of the piece of equipment itself. Once again, the importance of having more information about the school play environment can be appreciated.

Falling onto a hard surface

Our findings emphasized playground and playfield injuries. There was one intriguing finding, however, observed among injury incidents that occurred in outdoor locations other than the playground or playfield. Over 70% of those that involved falling occurred onto a hard surface. Further assessment of the circumstances of these injuries could lead to ideas for changes in the school environment that, if effective, could prevent a large number of injuries (i.e. 183 of the 2730 injuries reported to our system).

GENERAL CONCLUSIONS

Interesting findings about the characteristics of injuries that occurred at the 15 participating schools, from October 1993 through June 1996, resulted from the analyses of the injury data collected by the pilot elementary school injury surveillance system. It was important to confirm that many of our results were comparable to those reported by others in the literature. Some basic information about the involvement of play equipment, falling, and characteristics of the injured students was obtained and can be useful to others in planning similar projects and for other purposes. There are some important issues, however, that form the context within which these findings should be considered.

The use of a broad case definition, which included all school injuries, was perhaps not best suited for accomplishing the objectives of learning more about playground and playfield injuries and, in particular, those that were equipment related. The interest in playground equipment and the play environment as risk factors for school injury could not be studied in depth because of the limitation of available environmental information. This project was designed to collect information about injuries. Linking injury information to school hazard information is another step that would be important to take in identifying potential sources of injury risk in the school setting, and, furthermore, in developing strategies to eliminate or reduce those risks.

Would this surveillance system design serve to accomplish the type of risk factor identification mentioned above if the information were available? There were difficulties encountered as reported in the summary evaluation of the surveillance system(see Results: Surveillance System Evaluation, page 19). A better understanding of the reasons for injury data collection and the ways in which it would be used may have facilitated the implementation of the system. Beyond this, however, a simpler protocol for reporting injuries, possibly building on already existing procedures with which the school personnel were familiar, might have been more easily accepted. Addressing these and other system issues presented in this document, could enhance the acceptance of a protocol for collecting injury at schools by school staff. This should be an important consideration, among others, in designing other school-based injury monitoring efforts and related activities.

SUMMARY OF FINDINGS

Characteristics of injury

Based upon the 2730 injuries reported to the pilot surveillance system a weighted average crude injury rate of 17.6 injuries per 100 student years was calculated. Injury rates varied considerably between schools and there was a notable decline in injury rate at many schools during the second year of data collection. Six of the 15 schools, nevertheless, showed more consistent reporting over time and more stability of injury rates over time than the other 9 schools. Most injuries occurred in the morning or during the noon hour, when recess and other outdoor activities were scheduled at most of the project schools. Assessment of injury reports for kindergartners through 5th graders showed that boys and girls had similar injury rates through the 3rd grade. After third grade the injury rate of boys increased over that of girls by about 40%. Grade level comparisons showed that injuries affecting kindergartners were more frequently associated with equipment and falling than were those incidents affecting the older children.

Playground and playfield injuries

Nearly 70% of injury incidents reported to this pilot system took place on the playground or playfield. Play equipment and falling were important factors in injury occurrence with about half of all playground/playfield injuries involving falling and almost half involving play equipment. Equipment involvement was associated with grade-level: a higher proportion of injured kindergartners had equipment involvement reported than did the older injured elementary school children included in this project.

More intensively treated injuries

About 13% of equipment associated playground/playfield injuries were treated off-site at a clinic or hospital. There was variation in the percent of more intensively treated injuries during each year of data collection. During year 2, when there was a decline in injury reporting at many schools, there was an increase in the overall percent of more intensively treated injuries to about 17%. In year 1, about 9% and in year 3 about 13% of the injuries were more intensively treated.

Specific types of equipment involvement

More than 80% (n=608) of the 738 injury incidents that were equipment related reported one of four types of equipment: the structure, the overhead apparatus, the tire swing, or a type of climber. Most of the climber injury incidents occurred on the spinner or on the dome climber. Nearly 20% of the 175 injury incidents related to the overhead apparatus or the spinner were treated off-site at a hospital or clinic. Nearly 75% (n=128) of these 175 injury incidents involved falling. For the spinner associated injury incidents 96% of these were falls from an elevated height and about 20% of those injury incidents were more intensively treated. For the overhead apparatus related injury incidents, all involved falling from an elevated height with 28% reporting more intensive treatment.

Injuries involving falling in outdoor locations other than playground or playfield

In addition to the 1837 injury incidents that took place on the playground or playfield, another 398 (about 15% of the overall total) took place at an outdoor location other than the playground or playfield. About 75% of the 244 ‘other outdoor location’ injury incidents reporting falling, occurred onto a hard surface such as concrete or blacktop.

Play equipment and other injury risk factors in the school setting

The total number of pieces of each type of play equipment at the schools was not directly associated with the frequency of injuries reported for each type of equipment. The structure was the most commonly reported type of equipment related to injury incidents reported to the surveillance system. The spinners, however, were the most numerous type of equipment. No other equipment or playground information was available for the analyses done for this project. Thus it was not possible to identify more specific risk factors related to the play equipment, or playground and playfield environment, that were associated with injury incidents reported to the system.

Pilot injury surveillance system modifications

The results of the evaluation of the pilot elementary school injury surveillance system suggested modifications that could help to address some of the issues that affected injury reporting at most of the participating schools. Some of these changes included: a more specific case definition; a simpler protocol that would integrate better with the existing injury incident recording procedures at many of the schools; more consistent training and support for school personnel responsible for injury reporting to the surveillance system.

An idea for school-based injury reporting

At two of the pilot project schools the injury reporting forms were completed through the combined use of playground aides who identified the circumstances and mechanisms of injury, and the school office personnel who completed the personal and outcome sections. These two schools were among the six that reported most consistently to the system.

Partnerships formed between the education and health communities

The results of this pilot project suggested that these two communities can find ways to better work together to address the problem of injury in the school setting and other public health issues that affect school aged children. Of particular importance was the suggestion that more involvement of and clearer role definitions of the parents, LHJ's, school personnel and DOH project staff, at the design and implementation phases, would increase the likelihood that a project similar to this one would meet it's objectives.

RECOMMENDATIONS

Objectives and goals of injury surveillance in schools

The design and implementation of school-based injury surveillance should include: (1) consideration of the needs of schools and others for the information that will be reported to the system; (2) consideration of the ways in which the data that is collected will be used to meet these needs. It is important to work out in advance the kinds of data analyses needed to provide the information that can be useful in achieving the system's objectives.

Injury surveillance in schools

The results of this project do not suggest that the next step should be advocacy for a statewide school-based injury surveillance system.

Evaluation of the pilot surveillance system, as well as assessment of the injury data that was collected, provided some ideas about how school injury might be monitored in the school setting. However, there are important modifications that need to be made to this system for it to be more acceptable at the school level; simpler reporting mechanisms are needed with strong central coordination. Also it requires the strong support and involvement of the principal. The uses of the data and the priority of this assessment activity for both schools and the state need to be considered before recommending further surveillance activities.

School environment information

The assessment of school-based injury risks, a necessary step preceding the systematic development of school safety strategies, requires information about potential injury risk factors at schools (e.g. playground equipment assessment for compliance with CPSC safety standards). It is recommended that, if available, this type of information could be prepared in a coded form that could be linked to injury data. The analyses of this type of data could be used to estimate the injury risk associated with school environment factors.

Case definition

The case definition used for this project was very broad (i.e. all treated injuries were reported to the system). It is recommended that careful consideration be given to this issue. The rationale for reporting injuries to a surveillance system needs to be related to the objectives of the system. The lower the level of specificity in a case definition, the more difficult it is to develop adequate documentation and training for school project personnel to assure that standard criteria are used in deciding which injury incidents to report to the system. Unless there is a good reason to use a broad non-specific case definition, it is recommended that a more specific one be developed (e.g. all injuries that took place on the playground or playfield).

Injury reporting form

Though generally well accepted, there are some recommended changes that would streamline the injury reporting form. It needs to be reviewed and any items that were not used, such as birth date, should be deleted. Unless reliable follow-up procedures can be developed, that section of the form should be simplified. The coding scheme used should be reviewed for consistency and simplicity. Finally, *AGE* and a unique identifier that can be traced back to the student should be added to the form. *AGE* is important as an adjunct to *GRADE*. Children in a specific grade may vary in chronological age. This may be related to developmental level and thus, also, to the characteristics of injury. *GRADE* provides useful information related to play activities, curriculum, scheduling, and other factors. Inclusion of a unique identifier on the injury form would enable assessment of the impact of multiple injuries

per student. This would also provide a means to check for duplication. Confidentiality must be considered in developing an identification system.

Administrative and personnel issues

This project would have benefited from some changes in the project team composition. The number of people responsible for field visits could have been expanded to two. This could have been designed so that one person worked on technical issues such as the assessment of playground equipment or play environment (e.g. play surfacing depth). The second person could have then been responsible for actually collecting the injury reporting forms, discussing any questions with the school project personnel, and general communication between the local health offices, the state and the schools. Finally, the involvement of an epidemiologist from the beginning of the project would have helped to identify data quality issues as they arose. It is recommended that consideration is given to these suggestions in developing any similar activities.

Implications of the results for future school injury surveillance

The partnerships developed in the implementation of this project are important to the continued enhancement of building capacity at the state level to address issues of public health and safety in the schools. These should be recognized and continued efforts made to find ways to build on this starting effort. In particular, any future school-based injury surveillance projects should be developed with more involvement of parents, school staff, and LHJ personnel. Also, the role of the LHJ's should be more clearly defined.

Dissemination of information

The results of the project, interpreted appropriately and cautiously, need to be shared in an accessible way with a wide range of constituencies, especially the schools, parents, district personnel of the participating schools, as well as LHJ staff and others in the state. An important outcome can be the building of local capacity to develop more rational strategies for injury prevention.

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